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REPORT ON THE WORK OF THE SPECIAL ENQUIRIES BRANCH FOR THE FIRST TWELVE MONTHS OF THE WAR.*

THE special work of the Board in connection with the war began on 1st August, 1914, with an enquiry as to the supplies of wheat then in the country. With the assistance of several members of the corn trade enquiries were made by telegraph, and a Press *communiqué* was prepared, and issued on 4th August. These enquiries were continued, and supplemented, and a Special Enquiries Branch was established charged with the duty of collecting all available information as to the food resources of the country, and the effect of the war on farming generally.

A staff was collected from the Statistical Branch, and from other branches of the office, while the outdoor staff of the Statistical Division was enlarged by enlisting the services of inspectors from the Commercial Control Branch and the Land Division, and by the engagement of temporary officers. At present eight inspectors are stationed in various districts, all of whom are primarily attached to the Special Enquiries Branch, but are partly employed on other duties.

The inspectors furnish reports weekly on the general conditions of agriculture in their districts, with special reference to any circumstances arising out of war conditions. They also make enquiries on particular subjects as directed, and individual complaints are personally investigated by them.

In the month of August, 1914, the main energies of the Branch were directed to the collection of information as to home-grown food supplies, and on the basis of this information

* NOTE.—The separate publication of reports on the work of the various Branches of the Board has been suspended for the present. Such reports will appear in condensed form in this *Journal* from time to time.

the Board and the Agricultural Consultative Committee were able to issue a number of Press notices. Returns of stocks of wheat and flour, meat and provisions, oilseeds, cake, and fertilisers were obtained, and memoranda prepared as to existing and prospective supplies, and prices of the principal agricultural commodities. After a very short period the enquiries as to food supplies, and similar questions, developed largely in the direction of ensuring that the maintenance of those supplies was secured by preventing the undue export of commodities which were required at home.

The Work of the Inspectors.—The complaints received from farmers and others in the early stages of the war were very numerous. They arose mainly from the somewhat marked rise in the price of commodities, such as feeding stuffs, which was considered by buyers to be unreasonable. The sellers were usually able to show that the difference between the price charged by them and the wholesale price in some neighbouring market was due to the addition of charges, which could not be regarded as unreasonable, in respect of carriage, delivery of small quantities, and long credit. There can be little doubt, however, that the enquiries of the inspectors exercised a moderating influence on prices, and the knowledge that enquiries might be made tended to prevent excessive charges in other cases.

A second class of complaint, which was common at one period of the year, arose from the assertion that farmers were unduly withholding wheat from market. No foundation was found for this statement, which appeared to arise mainly from temporary delays in threshing caused by unfavourable weather. Numerous complaints by farmers as to the action of the War Office in regard to the purchase of hay were investigated, and enquiries were also made in numerous instances as to cases of the slaughter of pregnant cows and sows, and of young calves. Reliable evidence as to the prevalence of this practice was thus collected.

A large number of cases relating to other subjects, such as labour and transport difficulties, etc., were investigated. Interviews with farmers and with representatives of agricultural associations have been very numerous, and these have afforded opportunities both for hearing farmers' views, and for advising them on many subjects.

The inspectors have been called upon at frequent intervals to make special enquiries as to the position in their districts as regards certain agricultural questions. For example,

the supply of labour, and the effect of recruiting; the slaughter of immature and breeding stock; the decrease in the consumption of meat; the condition of the poultry industry, and the effect of the war on small holders; the supply and prices of fertilisers, agricultural seeds, hay and straw, and fresh and condensed milk, have all been the subject of special enquiry, apart from the general observations on these subjects which are included in the weekly reports. In addition, the supply of steam ploughs, and threshing and other agricultural machinery, the prevalence of stack fires, the supply of baskets and hampers, and of glass jars for the jam and fruit preserving industry, have been enquired into with useful results.

The inspectors were also asked to draw attention to exceptional circumstances in regard to agricultural conditions to which it seemed desirable to direct the notice of the Board. In this respect there can be little doubt that their reports have been of great value in keeping the Board promptly and systematically informed as regards the prevailing agricultural opinion on subjects to which attention has been directed at one time or another during the year. The inspectors of the Special Enquiries Branch have, by constant personal contact with farmers, been able to report views which would otherwise not have reached the Board.

Collection of Information as to Supplies of Agricultural Commodities.—In addition to enquiries already mentioned as having been made into the supplies of wheat at the outbreak of war, enquiries were made by the inspectors, and information was obtained from other sources as to the supply of other agricultural foodstuffs, and a general review of the position was prepared for the information of the Board on 9th August, showing the normal consumption, imports, existing stocks, and prospective supplies of grain, corn offals, meat, provisions, oilcake, fertilisers, etc.

The enquiries thus instituted were repeated on 1st September in a more systematic manner, and have since been continued monthly.

In continuation of the general review of the position as regards the supply of agricultural foodstuffs, referred to above, a detailed examination of the trade in all agricultural commodities has been made and incorporated in memoranda and reports, which are revised and brought up to date at frequent intervals. They were intended not only to show the position of this country in the event of any serious interference occurring in our import trade, but also to supply materials

for arriving at decisions in regard to the export of numerous articles, the export of which was only allowed by licence.

Control of Supplies through the Prohibition of Exports.—On the outbreak of war, Proclamations were issued prohibiting the exportation from the United Kingdom of “forage and food of all kinds for animals,” and “provisions and victual of all sorts which may be used as food for men.”

These Proclamations were subsequently amended and revised in many ways, and at the present time the export is prohibited of all feeding stuffs, cereals, and fertilisers, together with certain other articles, such as clover and grass seed, binder twine, malt, etc.

Notwithstanding the formal prohibition of the export of the specified commodities from this country, export may be allowed under licence. The issue of licences is controlled by the War Trade Department, who are advised by the Board of Agriculture as regards agricultural commodities.

The extent of the work in which the Board are concerned may be gathered from the fact that over 11,000 applications for export licences were dealt with between 1st September, 1914, and 31st August, 1915, and the monthly number of applications rose from 143 in September, 1914, to 1,741 in August, 1915. The number of separate articles on which recommendations have to be made on behalf of the Board was 93 at the end of September, 1915.

The two objects which are kept in view in advising the War Trade Department as to the action to be taken on the applications submitted, are (1) the conservation of our home supplies, and (2) the prevention of goods reaching the enemy. In regard to the first object, the position of our home stocks, prices, and prospective imports are studied by the staff of the Special Enquiries Branch, and the export is carefully controlled on the basis of the comprehensive information which is collected for this purpose.

The prevention of goods reaching the enemy is primarily the function of the War Trade Department, but, in practice, the consideration of this question is, to a large extent, combined with the question of supplies.

On the one hand it has been very desirable, on national grounds, to avoid undue interference with any legitimate export trade, while, on the other, it has been necessary to ensure that the export was approved of only such commodities as could be spared from this country without injury to the home consumer. In order to maintain, and, if possible,

develop trade, exporters made urgent representations in support of their applications, and in many cases were encouraged thereto by the fact that prices abroad were appreciably higher than in this country. These applications were very frequently supported by the Governments of our Allies, or of neutral countries, and had to receive special consideration.

It was also necessary to consider the maintenance of the supply of food imported into this country. Certain neutral countries have established a regular trade in the supply to the United Kingdom of a large proportion of its requirements of butter, bacon, eggs, margarine, and condensed milk, and the continuance of this trade was obviously desirable. It became evident on the outbreak of war that, in order to maintain these supplies of food, the countries concerned required to obtain feeding stuffs, for the supply of which they had hitherto been dependent partly on this country, and partly on other sources which had been cut off. Mutual arrangements were accordingly made as far as possible so as to maintain normal conditions. In all such arrangements special care was taken to ensure that any exports allowed from this country should be restricted to those which could best be spared, having regard to the full information in the possession of the Board as to the present and prospective stocks of each article.

The requirements of other neutral countries, as well as of our Allies and of British Possessions, have also had to receive special consideration.

This new class of work naturally gave rise to questions of much complexity in regard to which no guidance from past experience was available. It may be of interest to draw attention here to a few of the difficulties which have been met with—difficulties which in most cases were made more acute by the fact that the would-be exporter expected a decision to be reached immediately his application was made.

From the point of view of supplies, it quickly became apparent in the case of articles which are mainly imported that the mere prohibition of export would not necessarily increase the supplies in the country. If, owing to a momentary lack of demand at home or high prices abroad, importers were disinclined to buy, the stocks in this country of any particular article might run down to a very low figure although absolutely no export had taken place. It became, therefore, a question whether the importer would not buy more freely, and thus maintain supplies at a higher level, if he were allowed to continue an export trade.

There were, in fact, only a limited number of articles in which absolute prohibition clearly tended to increase the supply in the country. These were, mainly, by-products produced in course of manufacture of other goods. Milling offals are an example. They are produced in the manufacture of flour, and although inability to dispose of them except at a very low price would raise the price of flour it would not in itself reduce the quantity manufactured. There were at first very plentiful supplies of wheat in the country, and milling was very active, so that for a time it was possible to allow a limited quantity of milling offals to be exported without detriment to any national interest. As soon as it became apparent that the home demand was sufficient to prevent the mills from becoming congested, and their stocks from deteriorating, the issue of further licences was stopped, and no export of milling offals was sanctioned by the Board after October, 1914. By the policy adopted the total supply of milling offals in the country was increased by about 200,000 tons over that available for home consumption in the previous year.

One difficulty connected with the licensing of exports arises from the fact that in many cases the effect of restricting the re-export of imported goods is to take the trade out of the hands of British merchants, and to cause foreign buyers to import direct from the country of origin. The result of this is twofold. In the first place, the trade is placed in the hands of foreigners, and the probability of supplies reaching the enemy is thereby much increased. In the second place, the quantity of goods coming to this country at any particular time tends to decrease, with the result that the total quantity available is diminished.

Reference may be made also to the fact that trade interests were in some cases conflicting. Instances arose in which one group of traders very urgently desired to export while another group represented that any such export would be prejudicial to the interests of the home consumer.

The prohibitions have on the whole been effective as a means of conserving our supplies of agricultural commodities. They have probably had comparatively little effect on the general level of prices, which have been governed by other causes, but they have undoubtedly prevented the undue depletion of our stocks. In the absence of the control afforded by the prohibitions the much higher prices which could be obtained abroad would frequently have resulted in such a drain on our home stocks as to cause a shortage and consequently great in-

convenience, and no doubt in some cases considerable fluctuations in price. In certain cases the prohibitions have undoubtedly been effective in moderating the rise of price in essential commodities, and especially in foodstuffs.

Meat Supplies.—The work of the Special Enquiries Branch under this head has been directed towards ascertaining (1) the probable requirements of the United Kingdom; (2) the prospects of supplies (a) from abroad, and (b) from the slaughter of home stock; (3) the measures necessary to ensure that the demand for meat should not lead to such a drain on the live stock of the United Kingdom as might endanger future supplies.

Normally, about 40 per cent. of the supplies of beef and mutton (including veal and lamb) required by the United Kingdom comes from abroad. After the outbreak of war, supplies from overseas were affected by the requirements of the British and French Armies. The supplies thus diverted could not be readily replaced by increased imports owing to (1) the lack of vessels, and particularly of vessels fitted for the carrying of refrigerated meat, and (2) the lack of facilities for refrigerating meat in countries from which little or no meat had previously been imported. The reduction of imported supplies could not be made up from home stock, except by slaughter to a degree likely to endanger future supplies, and such slaughter was only probable (other circumstances being normal) under the influence of high prices. There was no material rise in prices, however, before the end of the year, but in the meantime the increased cost of feeding stuffs led to excessive slaughter of some classes of animals, more especially pigs. Later, the general rise in the prices of feeding stuffs, together with the shortage of labour due to recruiting, tended to lead to increased marketing of live stock, more particularly on the part of dairy farmers. From the beginning of this year prices of meat, and consequently of live stock, rose rapidly, and reports began to reach the Board that the slaughtering not only of young animals, but also of female breeding stock, was being carried out to a dangerous extent.

In considering the prospects of supplies of meat, it was thus not sufficient merely to ascertain the quantities likely to be imported from abroad, and the surplus after meeting the requirements of the British and French Armies, and to estimate the probable supply from home stocks. Account had also to be taken of the effect on the slaughter of home stock of the various factors already indicated, viz., the shortage of imported supplies, the high prices offered for live stock,

the increased cost of feeding stuffs, and the shortage of labour, and, on the other hand, any change in the consumption of meat arising from high prices, from motives of economy, from a reduced civil population owing to enlistment, from increased wages, and so on.

The position was closely watched, and reports were obtained from time to time not only from the Inspectors of the Branch, but also from the Board's Market Reporters. The information thus furnished was supplemented by returns of animals slaughtered, obtained from local authorities owning public slaughterhouses, and the Board decided that a case for their intervention was established. After conference with the Scottish and Irish Departments and reference to the Agricultural Consultative Committee, an Order under the Slaughter of Animals Act, 1914, was passed prohibiting the slaughter of in-calf cows, in-pig sows, and of calves (with certain exceptions) under the age of twelve weeks. This Order came into force on the 24th June. Experience showed that it was necessary to obtain statutory powers beyond those conferred on the Board by the Slaughter of Animals Act, and the Maintenance of Live Stock Act, 1915, was in consequence passed. Under the latter Act, a new Order—the Maintenance of Live Stock Order of 1915—was passed by the Board, and came into force on the 23rd August. This superseded the previous Order, and met certain difficulties and hardships which the latter had occasioned. The administration of these Orders was entrusted to the Live Stock Branch.

The shortage in the meat supplies available for the civil population led to a consideration of the question of encouraging further imports from abroad. The foreign animals wharves, which were formerly used for the reception of such animals, could not be made readily available, as the trade in foreign cattle had practically ceased for some considerable time before the outbreak of war, but it was decided to re-open some of them, and in August Orders under the Diseases of Animals Act were passed, which permitted the landing, for slaughter, of animals from certain countries at Avonmouth and Cardiff, and from Canada at Birkenhead. No animals were in fact landed during the year.

A matter arising out of the work of the Branch on the subject of meat supplies has been the calling of the attention of agriculturists generally, by means of posters and circulars, and in other ways, to the desirability of maintaining, and, if possible, increasing the numbers of live stock in the country.

COST OF WINTER FEEDING IN MILK PRODUCTION.

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THE cost of production of milk on the farm is a matter of the greatest importance to a milk producer. It involves many factors, such as the labour in attendance and milking, depreciation in the value of the cow, illness and calving risks, interest on capital, cost of litter, etc., and all these have to be considered before it is possible to say what it actually costs the farmer to produce his milk, but the principal item of expenditure is undoubtedly the cost of the food.

An investigation was begun by Wye College in 1908 with the purpose of arriving at some reliable estimate of the cost of feeding dairy cows in the South-Eastern district of England. During the winters of 1908-9-10 a milk recorder paid single visits to a large number of farms in Kent and Surrey, and weighed the food fed to the cows, and the milk yielded on the morning and evening of his visit, but in the winter of 1911-12 a change was made in the system adopted, and during the past three seasons the recorder has paid a series of monthly visits, summer and winter, to a smaller number of farms because it was thought that the data so obtained would be more accurate.

All the farmers concerned were asked at the beginning to estimate the cost per ton of growing their different home-grown foods, but these estimates varied so widely on the individual farms that it was found desirable to take the average costs per ton, and to use these as a basis on every farm, and in every season. After arriving at the averages, therefore, from the estimates given, the following prices per ton were fixed upon, and used in all the subsequent calculations :—

	<i>s. d.</i>
Mangolds, Swedes and Cabbages	10 0 per ton.
White Turnips	8 0 "
Chat Potatoes	20 0 "
Meadow Hay	60 0 "
Oat, Pea and Bean Straw	40 0 "
Barley and Wheat Straw	25 0 "

The labour in the preparation of the foods is not included, and must be charged to the labour account. The figures

may be criticised as being too high or too low, but they are the mean of the estimates supplied, which varied between the following limits: hay, 50s. to 70s.; mangolds, 6s. 8d. to 15s.; oat straw, 35s. to 60s. At the present time, with an increase in the cost of labour and manures, it may quite reasonably be argued that the costs agreed upon before the outbreak of war are now too low. Home-produced meals were taken at the estimates given, and purchased cakes and meals at the price actually paid for them with a small allowance for cartage.

In making the calculations for the individual farms, only the foods fed to the cows actually in milk were included. The foods fed to dry and fattening cows were not taken into account. It was considered that the value or the sale price of a fat cow and of the calf would, on the whole, give a return balancing the cost of the food used when the cows were dry.

The winter period covered by these figures has been taken to be from 1st November to 30th April (26 weeks). A summary of the results for the past three winters is shown in the following table:—

TABLE I.—*Summary of the Results for Three Winters.*

No. of Herds.	No. of Cows in Milk.	Daily Yield per Cow.	Cost of Food per Cow per day.	Cost of Food per gal. of Milk.	Average Daily Rations.				
					Roots.	Hay.	Straw.	Wet Grains.	Cakes and Meals.
		Gal.	Pence.	Pence.	lb.	lb.	lb.	lb.	lb.
20 (1914-15) ...	619	2'13	12'18	5'72	39	9'0	6'3	1'4	7'7
18 (1913-14) ...	632	2'23	12'15	5'40	52	9'4	3'9	4'7	7'2
11 (1912-13) ...	415	2'12	12'22	5'76	56	6'5	5'2	4'5	7'5
Average ..	1,666	2'17	12'22	5'63	49	8'3	5'2	3'5	7'5

It will be seen that the average daily yield of milk per cow was 2·17 gal. (which can be translated into yield during the milking period—42 weeks—by multiplying by 294), the daily cost of food 12·22d., and the cost of food per gal. of milk 5·63d. The cost of feeding in the winter of 1914-15 was slightly higher than in the previous winter on account of the increased prices of purchased foods, but most of the farmers had made their winter purchases before prices had seriously advanced, so that the effect is much less than might have been expected. Every year there was very great variation in the cost of feeding on the different farms, as is shown by the following figures:—

TABLE II.—*Farms Classified According to the Cost of Feeding.*

Cost of Feeding.						Number of Farms.		
						1914-15.	1913-14.	1912-13.
Less than 5¢. per gal.	..	..	..	..	..	5	8	1
From 5¢. to 6¢. per gal.	..	..	..	..	..	7	6	2
" 6¢. to 7¢. "	..	..	..	..	..	6	3	1
" 7¢. to 8¢. "	..	..	..	..	..	1	1	0
" 8¢. to 9¢. "	..	..	..	..	..	1	0	0

In the winter of 1912-13 the two extremes were 4·30*d.* and 7·46*d.* per gal. of milk; in 1913-14 4·21*d.* and 7·08*d.* per gal.; and in 1914-15 4·64*d.* and 8·18*d.* per gal. In every year the feeding was costing nearly twice as much per gal. of milk on some farms as on others; and yet on every farm roots, hay, and straw were valued at the same prices, and each farmer had the same opportunity of buying the same concentrated foods at practically the same prices in the open market. Under these conditions it would seem that if some farmers can produce milk at between 5*d.* and 6*d.* per gal. for food, others ought to be able to do the same, provided cost prices are normal.

By dividing all the herds up into three sets—Set I, those herds giving the cheapest milk; Set III, those herds giving the most expensive milk; and Set II, those intermediate—it is possible to eliminate the individuality of the different herds, and to obtain some information as to the reason why the

TABLE III.—*Comparison of Costs.* Winters 1912-13-14-15.

	Daily Yield per Cow.	Average Daily Ration.					Wet Grains.	Cakes and Meals.
		Cost of Food, per Cow per Day.	Cost of Food per gal. of Milk.	Roots.	Hay.	Straw.		
	Gal.	Pence.	Pence.	lb.	lb.	lb.	lb.	lb.
11 Farms, Winter 1912-13								
4 Cheap Herds	2'08	10'50	5'05	35	5'5	4'5	2'0	7'6
4 Intermediate	2'15	12'36	5'75	62	6'2	4'6	6'6	6'6
3 Expensive Herds	2'16	14'58	6'75	77	5'2	6'9	5'0	7'9
18 Farms, Winter 1913-14								
6 Cheap Herds	2'35	10'98	4'67	54	7'7	4'0	3'3	6'7
6 Intermediate	2'22	11'51	5'18	51	10'3	4'0	2'4	6'3
6 Expensive Herds	2'21	13'77	6'19	52	10'5	2'6	8'3	8'5
20 Farms, Winter 1914-15								
7 Cheap Herds	2'43	12'17	4'61	58	8'6	4'2	3'0	8'3
7 Intermediate	2'21	12'79	5'79	46	8'2	6'3	Nil	8'5
6 Expensive Herds	1'66	11'57	6'67	30	10'3	9'1	1'0	6'0
Average of all the above—								
17 Cheap Herds	2'30	11'22	4'88	43	7'3	4'5	2'8	7'5
17 Intermediate	2'19	12'22	5'57	53	8'2	5'0	3'0	7'7
15 Expensive Herds	2'01	13'31	6'63	63	9'6	6'2	4'8	7'5

cost per gal. is so much higher on some farms than on others. This is done in the table at the bottom of the previous page.

A heavy milk yield associated with a low cost of feeding is evidently the end to be aimed at in economical milk production. The figures of every winter have demonstrated this, and especially the figures of 1914-15, for last winter the seven cheapest herds averaged fully $\frac{1}{4}$ gal. of milk per head per day more than the seven intermediate herds, and the intermediate herds fully $\frac{1}{2}$ gal. of milk per head per day more than the six expensive herds.

It does not necessarily follow, however, that a heavy milking herd is a cheap milk-producing herd. The heaviest milking herd in 1914-15 only ranked sixth in the list from the standpoint of economy, and the most economical milk-producing herd averaged less milk per head per day than eight other herds. Milk yield, therefore, must be considered in relation to the cost of feeding. One has to distinguish between naturally heavy-milking cows, and cows that only yield well because they are liberally fed. Cows which milk heavily on a normal ration, and without heavy feeding, are the cows that pay best. Such cows can be obtained by breeding and occasionally by purchase, and it is a far sounder investment to pay a little extra for such cows, or to get a bull that will help to breed such cows, than to buy an ordinary class of cow and try to promote a good flow of milk by heavy feeding. High feeding will only to a very limited extent increase the flow of milk, and will always be an expensive proceeding.

One of the main reasons why some farmers have been so extravagant in feeding their cows has been that they have not fed according to the milk yield. If cows are all fed alike it naturally follows that the low-yielding cows will be overfed and food wasted, while the heavy-yielding cows will be underfed, and will be likely to fall off both in yield of milk and in general condition. The heavier the yield of milk the better should be the feeding, and *vice versa*. Every cow may have the same allowance of roots and fodder (the maintenance ration),* but the quantity of cake fed (the production ration)* should be strictly regulated according to the number of gallons of milk the cow is giving. The exact quantity needed will vary according to the mixture that is being fed, but as a rule from 3 lb. to 4 lb. per gal.

* Third Report on the Cost of Food in the Production of Milk in the Counties of Kent and Surrey, 1914, by G. H. Garrad. Issued by the South-Eastern Agricultural College, Wye.

of milk will be required. Thus, cows giving 1 gal. of milk a day should receive 3 lb. to 4 lb. cake and corn; 2-gal. cows, 6 lb. to 8 lb. cake and corn; 3-gal. cows, 9 lb. to 12 lb. cake and corn, and so on. A really heavy-milking cow is drawing very seriously on her constitution when her milk yield is at its height, as she is frequently unable to eat a sufficient quantity of food to supply all her needs, and consequently she loses condition. The proper course in such cases is to get cows that are known to be heavy milkers into as good condition as is safe before they calve, and then to feed them as liberally as possible during the period that they are in full milk.

The daily amount of milk each cow is giving should be chalked up periodically over her head, and the quantity of cake and meal should be measured out to each cow according to the figure thus recorded. This entails very little extra trouble and is a reasonable, scientific, and economical system of feeding.

At the commencement of this enquiry,† during the winters of 1908-9-10, the recorder paid only a single visit to a large number of farms in Kent and Surrey, and weighed the food fed to the cows on the day of his visit, and the milk yielded. These herds can be classified as follows:—

TABLE IV.—*Comparison of Costs. Winters 1908-9-10.*

—	Daily Yield per Cow.	Cost of Food per Cow per day.	Cost of Food per gal. of Milk.	Average Daily Ration.				
				Roots.	Hay.	Straw.	Wet Grains.	Cakes and Meals.
	Gal.	Pence.	Pence.	lb.	lb.	lb.	lb.	lb.
17 Cheap Herds	2'38	13'66	5'74	81	8'5	6'5	17'7	4'8
17 Intermediate	2'14	15'43	7'21	83	11'9	6'6	11'6	6'6
17 Expensive Herds	2'08	18'49	8'89	91	17'7	5'8	16'8	6'2
Average (51 Herds) ..	2'20	15'86	7'28	85	12'7	6'3	15'4	5'9

The figures bear out the conclusion already drawn from the farms visited regularly month by month during the past three years, that the most profitable herds are those that give the most milk on the cheapest ration. Of the seventeen expensive herds no less than six were being fed on more than 100 lb. roots per head per day, and seven more than 20 lb. hay. It was in these home-grown foods, roots and hay, that extravagance was particularly noticeable in the first stage of the

† First Report on the Cost of Food in the Production of Milk, 1910, by J. Mackintosh. Issued by the South-Eastern Agricultural College, Wye.

enquiry, but farmers in the scheme were quick in correcting these faults once they were pointed out to them. For this reason especially the cost of feeding during the past three winters has been considerably less than during the preliminary stages. Roots at 10s. per ton are equivalent to 20 lb. per 1d., so that 100 lb. of roots alone cost 5d. per day, and contain $8\frac{3}{4}$ gal. of water. One farmer was feeding 154 lb. mangolds per cow per day, and another 113 lb. roots and 43 lb. wet grains. In each of these rations about 14 gal. of cold water was being fed and the temperature of this water has to be raised to the temperature of the cow's body before she can make any use of her food. From an economical point of view it certainly seems undesirable to feed more than 60 lb. to 70 lb. roots per cow per day.

In the case of hay also, long hay was being fed practically without regard to quantity until it was pointed out that every lb. of hay wasted and trodden underfoot in the farmyard represented a loss of nearly $\frac{1}{2}$ d. to the farmer. On 22 farms (519 cows) an average of 20.3 lb. of hay per cow per day was being fed, and the cost of the milk averaged 7.77d. per gal. On another 30 farms (1,324 cows) an average of 7.8 lb. of hay was being fed, and the cost of the milk averaged 6.16d. per gal. There is every indication that the cost of milk production can be reduced by limiting the quantity of hay, and especially long hay, and replacing a proportion of it with oat straw. It is usually stated that a cow requires 20 lb. of fodder per day, but the average quantity fed on the farms embraced in the Wye College enquiry has been considerably less, about 13 lb. per day.

A summary of the winter feeding on all the farms during the past three winters is shown in the following table:—

TABLE V.—*Winter Requirements of an Average Cow (180 Days).*

	1912-13.		1913-14.		1914-15.	
	Quantity.	Cost per ton.	Quantity.	Cost per ton.	Quantity.	Cost per ton.
Root Crops—tons ..	4'75	s. d. 10 1	4'28	10 4	3'32	10 0
Fodder Crops—cwt. ..	18'54	49 0	21'16	53 0	23'14	51 0
Wet Grains—cwt. ..	7'42	19 3	8'48	17 10	2'29	21 6
Cakes and Meals—cwt. ..	12'01	136 0	11'34	129 0	12'48	136 6
Daily cost per Cow ..	12'22d.		12'15d.		12'18d.	
Daily yield per Cow ..	2'12 gal.		2'25 gal.		2'13 gal.	
Cost of Food per gal. Milk	5'76d.		5'40d.		5'72d.	

If an average of the three years is taken it will be found that the normal allowance of a cow for the six winter months (1st November to 30th April) and the cost of feeding are as follows :—

<i>Daily.</i>		<i>£ s. d.</i>	
51 lb. ..	4.12 tons Roots at 10s. 2d. per ton	2 1 11	(23 per cent.).
13 " ..	20.95 cwt. Fodder Crops at 51s. per ton ..	2 13 5	(30 ").
3½ " ..	6.06 cwt. Wet Grains at 19s. 6d. per ton ..	5 11 3	(3 ").
7½ " ..	11.94 cwt. Cakes and Meals at 133s. 10d. per ton	4 1 2	(44 ").
Total Cost of Food per Cow ..		£9 2 5	
Av. Daily Cost per Cow (£9 2s. 5d ÷ 180) ..		12.16d.	
" " Yield per Cow		2.17 gal.	
" Cost of Food per gal. of Milk		5.60d.	

Mackintosh, in his Reading Investigation* found that the average cost of food on 12 farms from December, 1912, to April, 1913, was 5.97d. per gal. (13.06d. per day), valuing his home-grown foods at the same prices as those taken at Wye, but that when the home-grown foods were valued at the actual cost of production on the individual farms this figure was revised to 5.83d. per gal., the daily cost of the ration being 12.75d. per head instead of 13.06d. The daily yield of milk was 2.18 gal. The Wye figures for the same period, using "average" costs of home-grown foods, were:—daily cost of food 13.11d., daily yield of milk 2.19 gal., and cost of food per gal. 5.99d. The farms in the Wye scheme, therefore, produced their milk at practically the same cost per gallon as the farms in the Reading scheme. The Nottingham Milk Record Society,† run under a scheme formulated by the Midland Agricultural and Dairy College, found that for the winter of 1913-14 the average daily cost of feeding was 1s. 6d., and the cost of food per gal. 6½d. In this case mangolds were valued at 12s. 6d. per ton instead of 10s., and oat straw at 35s. per ton instead of 40s. The Wye figures for the same winter (26 weeks) using similar values for mangolds and oat straw were:—daily cost of feeding 1s. 1d., and cost

* Bulletin XIX., University College, Reading: Milk Records, and Cost of Feeding Cows in Berkshire, 1913, by Jas. Mackintosh.

† Report on the Work of the Nottingham and District Milk Record Society for the year ended 31st October, 1914, by P. W. Bailey. Midland Agricultural and Dairy College.

of food per gal., 5 $\frac{3}{4}$ d. The length of the winter period adopted by the Nottingham Society is not stated in their report.

The question now arises—exactly how much effect has a difference in the cost of roots, fodder, concentrated foods, etc., on the cost per gal. of the milk? It has been shown that the cost of feeding a cow averaging 2.17 gal. of milk a day throughout the six winter months is roughly £9, or 1s. per day, and that the concentrated foods and wet grains together are responsible for 47 per cent. of the total cost. The roots and the fodder crops are responsible for the remainder of the cost, and, as much larger quantities of these are fed in comparison with the cakes and meals, it follows that an increase of a few shillings per ton in the cost of producing mangolds or hay is far more serious than the same increase in the price of concentrated foods. Four tons of roots and 21 cwt. of hay and straw are consumed for every 12 cwt. of cakes and meals, a proportion of 7 lb. of roots, and 1 $\frac{3}{4}$ lb. of fodder per 1 lb. of cakes and meals. An increase or decrease of 1s. a ton in the cost of production of the root crop, or 4s. per ton in the cost of the fodder crop is, therefore, equivalent to an increase of 7s. per ton in the cost of concentrated foods. A rise of as much as 7s. a ton all round in the price of purchased foods will always be looked upon as a serious matter, as, indeed, it is, but it is not realised that this corresponds to a rise of only 1s. per ton in the cost of production of the root crop, or 4s. per ton in the cost of production of the hay and straw crop. A 15-ton crop of mangolds in a bad season costs almost as much to grow as a 25-ton crop in a good season, and, if the cost is estimated in each case at from £8 to £10 per acre, this means a difference of about 5s. per ton in the cost of production. This is equivalent to a rise of 35s. per ton in the cost of concentrated foods, and may happen in any unfavourable season. Similarly, the yield of hay from a meadow may easily vary from 17 cwt. to 27 cwt. per acre in different seasons, and this will make a difference of about 30s. per ton in the cost of production of hay. A cow consumes 1 $\frac{3}{4}$ times as much fodder as she does concentrated foods, so that this increase of 30s. per ton in the cost of either home-made or purchased hay is equivalent to a rise of about 52s. 6d. per ton in the price of cakes and meals. Some of the fodder consumed by the cow would, of course, be straw, but the same remarks apply, as a short crop of hay usually implies a short crop of straw, and a short

crop of straw increases the cost of production in exactly the same way.

The effect of a dry summer is, therefore, not merely felt immediately in increasing the cost of production of summer milk by drying up the pastures and entailing more expense on artificial foods, but it has a very considerable influence on the cost of winter milk as well. With the figures already given it is evident that half a crop of roots will increase the cost of winter milk by about £2 per head (2·67*d.* per day, or 1·23*d.* per gal.), and half a crop of fodder by about another £2 10*s.* per head (3·33*d.* per day, or 1·53*d.* per gal.), so that a dry summer, resulting in only half a crop of hay and straw, will mean an increase of 2¾*d.* per gal. (50 per cent.) in the cost of winter milk, without taking into consideration the concentrated foods at all. A cow only consumes about 12 cwt. of cakes and meals during the 26 weeks, so that, even if all concentrated foods rose 50 per cent. in price, this would not make a difference of more than £2 per head (2·67*d.* per day, or 1·23*d.* per gal.) in the cost of feeding. The chief difficulties at the present time are the price of cows, the difficulty of getting milkers, and the increased cost of labour with the consequent increased cost of home-grown foods.

In conclusion, it may be repeated that a low cost of food per gal. of milk depends on a heavy milk yield and a low cost of daily feeding. The low cost of feeding can be obtained by feeding a well-balanced ration in the right quantity* according to the milk yield of the cow, and composed of the cheapest foods* relative to their composition that the farmer is able to procure. A saving of ½*d.* per gal. in the cost of feeding works out, in the case of a single 600-gal. cow, to a reduction of £1 5*s.* in the food bill for the year, or, in the case of a herd of 30 cows, to a saving of £37 10*s.* per annum. A saving of ½*d.* per gal. in the cost of production is equivalent to obtaining an extra ½*d.* per gal. for the milk. Experience shows that in many cases a reduction of considerably more than ½*d.* per gallon can be effected, so that the slight increase in labour involved by the regular weighing or measuring of the food and the milk is very handsomely repaid by the results.

A heavy milk yield can only be obtained by careful breeding. Weekly milk records should be kept, and the figures added up

* Fourth and Final Report on the Cost of Food in the Production of Milk, 1915, by G. H. Garrad. Issued by the South-Eastern Agricultural College, Wye.

from week to week until the year is complete. The information so obtained should then be acted on. All the worst milkers should be eliminated and fattened off, and the best cows put to a bull of a good type, with a good milking ancestry, and the heifer calves reared. In that way the milk records of the whole herd will be gradually improved from year to year, and it can be easily proved that the more milk a cow gives the cheaper in proportion becomes her feeding. In most herds there are some cows that are not even paying for their keep, and the sooner these are discovered, and weeded out, the better. A 700-gal. cow will only cost, if fed scientifically, about 25s. more to feed than a 600-gal. cow, and, in return for the increased outlay, the owner gets an additional 100 gal. of milk, which, at an all-round price of 8d. per gal., would be worth £3 6s. 8d. She thus brings in £2 1s. 8d. more, net revenue, during the year than the 600-gal. cow, and an 800-gal. cow will bring in £4 3s. 4d. more, net return, than a 600-gal. cow.

The annual milk record of the cows that have been in the Wye Scheme during the past three years has averaged 656 gal. This figure is high, and is due to the fact that most of the farmers who take a hand in such an investigation as has been described are progressive farmers. 22 per cent. of the cows gave more than 800 gal., and there were 15 entire herds that averaged between 700 gal. and 800 gal. per head. These herds, when fed economically, are the ones that pay best, and form the standard at which every dairy farmer should aim. Full reports giving the details of the Wye College Milk Investigation have been published, and can be obtained at cost price by applying to the Secretary of the College.

NOTE.—It should be pointed out that no allowance has been made in this article for the manurial values of the feeding stuffs used in the investigation. This omission has been made intentionally, because the different systems of management of the dung and liquid manure on the various farms have made it impossible to use any recognised system of valuing the manurial residues, such as Hall and Voelcker's table for "cattle fattening in boxes or yards where there is no avoidable loss by drainage, and where the manure is not washed by rain." It should also be noted that the valuation of the cows at the beginning and end of the period was not taken into consideration.

THE USE OF PRESSED APPLE POMACE.

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UNDER existing conditions it is of national importance that the maximum use should be made of all agricultural produce. While it is probable that good value is already being obtained from ordinary crops and stock, more attention, perhaps, could be profitably given to the by-products of the farm. Some of these may be only of purely local interest on account of their restricted occurrence; but others of more general distribution deserve special consideration. The subject of this article, cider apple pomace, although it does not occur in all parts of the country, is produced in a fairly wide area. It is a product of most farms in Devon, Somerset, Gloucester and Hereford, and to a less degree in Monmouth and Worcester, and also in some districts of the counties adjacent to these. Outside the West of England it is produced in appreciable quantities in parts of Norfolk and Kent, and in small quantities in a few other counties. It is found, in addition, in some localities in Ireland,

Meaning of the term "Pomace."—The term pomace (in some districts it is called "must" or "mark") is used in the cider-making industry to denote the apple pulp in the form in which it is obtained after the fruit has been passed through the cider mill. Sometimes it is further limited to the pulp in the condition in which it comes from the cider press after the juice has been extracted. The material to which attention is here primarily given is the pulp in the latter state. Although the name pomace is used more particularly with reference to the pulp of cider apples it is also applied to the corresponding state of perry pears, and in this article the term is applied without distinction to the product of both apples and pears.

Quantity of Apple and Pear Pomace Produced.—The total quantity of apple and pear pomace produced annually in this country is considerable, and is certainly large enough to make the study of methods for its use worth while. No reliable direct statistics as to the amount are available, but it is possible to gain a rough idea by indirect calculation from the estimated annual production of cider and perry. According to the Report by the Board of Agriculture and Fisheries on the *Agricultural Output of Great Britain*, the estimated total production of cider and perry in 1908 in this country was approximately 22,133,000 gal. Reckoning at the rate

of 125-150 gal. of *mature* cider from 1 ton of fruit,* a standard which experience has shown to be fairly representative of the capacity of the various types of cider presses used in this country, this figure is equivalent to an approximate crop of 147,500-177,000 tons of cider apples and perry pears, and a yield of 44,250-53,100 tons of pressed pomace. The weight of pressed pomace from a ton of fruit varies somewhat. It is here taken as 30 per cent., a fair average figure.

There are various reasons for regarding this estimate as a low one. The year's output, if intended to refer to the cider and perry made during the winter 1907-8, was much below the normal owing to the poor crop of fruit. The late Mr. C. W. Radcliffe Cooke, one of the best authorities on cider of recent years, held that the quantity of cider produced annually reached a much greater figure than that already quoted, and concluded (in an article in the *Nineteenth Century* for 1901) that the total production was not less than 100,000,000 gal. a year. This is probably equivalent to a crop of 666,667-800,000 tons, or a yield of 200,000-240,000 tons of pressed pomace. Mr. John Ettle, late Horticultural Instructor for Somerset, from an intimate knowledge of the cider orchards in that county, reckoned in his evidence before the Departmental Committee on the Fruit Industry of Great Britain, 1904-1905, that the average orchard gave a yield of 275 gal. (5 hog-heads) per acre. The total acreage under cider and perry fruit probably being approximately 100,000 acres, this estimate corresponds to a total annual yield of 27,500,000 gal., *i.e.*, 183,333-220,000 tons of fruit, or 55,000-66,000 tons of pressed pomace.

The only actual figures of the yield of a typical English cider orchard which we have available are those from the old orchard at the National Fruit and Cider Institute. This orchard, well over 80 years old, and fast dying out, yielded crops in 1907, 1908, 1909, 1910 and 1911 at the rate of $\frac{1}{4}$ ton, 1 ton, $1\frac{3}{4}$ ton, 1 ton and $\frac{3}{4}$ ton per acre, respectively, without taking into account a small quantity of dessert and cooking apples which were not used for cider making. This orchard was 5 acres in extent. at least half of the ground was bare of trees, and the great majority of the trees were worn out and unproductive. It may also be mentioned as an established fact that yields of from $\frac{1}{2}$ to 1 ton of fruit from single trees are by no means uncommon in some cider and perry orchards. On the strength of these figures, and at the same time making

* In the case of *apples* used on farms for cider-making the Board's estimate was 175 gallons from 1 ton of fruit.

allowance for the fact that many old orchards are in very similar condition to that mentioned, it seems probable to us that in an average year the total crop of cider fruit is not less than 200,000-250,000 tons, representing a yield of 60,000-75,000 tons of pomace. In any case it is evident that the total quantity available each season is sufficiently substantial to justify consideration of methods for its use.

Composition of Pomace.—The main constituents of the pressed pomace are carbohydrates, principally dextrose and lævulose, with starch and pectins which vary in quantity according to the state of ripeness of the fruit at the time of milling. In addition, smaller quantities of woody fibre and of nitrogenous bodies and fats also occur. The percentage of water is considerable and ranges from 60 to 80 per cent. of the total weight. Since the composition is practically the same as that of the fruit, minus the juice expressed, it follows that it will depend very largely upon the amount of juice extracted during the pressing. This is a very variable factor. It is affected by the efficiency of the mill and press employed, and also by the length of time to which the pulp is subjected to pressure. Further, the pomace is sometimes broken up again and pressed a second time; and in some districts a certain proportion of water is added, either before the first or second pressing, in order to aid the extraction of the juice. The percentage of residual soluble solids in the pressed pomace is in such cases somewhat reduced. The condition of ripeness of the fruit at the time of milling also affects the quantity of juice extracted, a larger quantity being obtained from ripe fruit than from fruit not quite ripe or, especially, over-ripe. Individual varieties of apples and pears vary greatly in composition, while the kind of soil upon which the fruit was grown, the age of tree, and the character of the season, also have much influence upon composition.

The table gives some figures showing the amount of nutrients in some typical samples of fresh pomace. Most of the analyses were made at the Bristol University Research Station. The authorities for the remainder are named. Corresponding figures for mangolds and wet brewers' grains are given for comparison.

It will at once be seen that the apple pomace is very variable in composition, though probably not more so than other fresh vegetable foods. Speaking generally, it is of distinctly higher feeding value than mangolds. It falls below wet brewers' grains as regards the amount of protein, but is richer in carbohydrates.

Composition of Pomace.

	Mixed Apples. (Wolff.)	Mixed Apples. (War. collct.)	Mixed Apples. (Lloyd.)	Mixed Apples. 1913.	Mixed Apples. 1915.	"Bell" Apple. 1915.	"Ponsford" Apple. 1915.	"Cap of Liberty" Apple. 1915.	Pear. 1915.	Wet Brewers' Grains.	Mangolds (medium)
Water ..	71.3	78.15	72.4	74.0	76.05	68.39	75.39	75.37	65.52	76.2	88.0
Fat, etc. (Ether extract)	1.3	0.82	1.08	1.24	1.12	1.43	1.22	(1.20)	1.30	1.7	0.1
Protein ..	1.4	1.5	1.27	1.82	1.53	1.03	1.54	1.33	1.50	5.1	1.2
Crude Fibre ..	10.5	7.15	4.64	5.14	4.42	6.52	5.75	4.30	7.86	5.1	0.9
Ash ..	1.3	0.92	2.27	1.11	0.71	0.65	0.56	0.76	0.92	1.2	1.1
Carbohydrates (Sugar, etc.) ..	11.2	9.5	18.34	16.69	16.17	21.98	15.54	17.04	22.90	10.6	8.7

UTILISATION OF POMACE.

The chief difficulty to be faced in attempts to use pressed pomace is the rapidity with which decomposition sets in. The two principal changes which take place in the early stages are alcoholic fermentation and the production of acetic acid. These changes are brought about by what is called locally the "heating" of the pomace, a considerable rise in temperature taking place, and a great part of the sugar being converted into alcohol and acetic acid. The rate of these actions depends upon the prevailing temperature. Further changes leading to putrefaction occur if the pomace remains moist. It is, therefore, important that in all attempts to make use of this material it should be dealt with as soon as possible after it comes from the cider press. If it cannot receive immediate attention it should be stored in the coolest available place and be kept as dry as possible. The question of preservation is considered in a later section.

Pressed pomace has long been used on farms in the cider-making districts as a food for stock. Hogg and Graves Bull in the *Herefordshire Pomona* (1876-1885) mention also its use as a manure, and sometimes, on small holdings, as fuel when dry.

Cider makers in some instances employ the pomace for making a weak form of cider, "small" cider or "washings" (the French "petit cidre"), by adding a limited quantity of water and re-pressing. Another somewhat similar method, which has been investigated in some detail at the National Fruit and Cider Institute, consists in using it to improve low-grade ciders or those affected with acetification and other taints. These methods are considered below.

There are other possibilities which deserve consideration, such as using the pomace for vinegar production or for making cider and perry brandy; but they are somewhat complicated for farm purposes and will, therefore, not be further dealt with here.

There is also some prospect that profitable use could be made of the pectin content of pomace for industrial purposes. A product called "Apple Pectin" has recently been introduced into this country, and it is claimed that it will cause jams to set which will not readily do so themselves. Enquiries have shown that an article of this kind might prove very useful in the jam-making industry; and investigations are now in progress to ascertain if a suitable preparation could be obtained from cider pomace.

Pomace as a Feeding Stuff.—There are very few figures available for the proportion of the principal nutrients which

are actually digestible. Warcollier, in his book *Pomologie et Cidricerie*, quoting from Wolff's tables, gives for apple pomace a content of *digestible nutrients** of about 1 per cent. of protein, 1.2 per cent. of fat, and 12.5 per cent. of carbohydrates. The nutritive ratio* *i.e.*, the relative proportion of digestible proteins to carbohydrates and fats is about 1:16; and in these days of high-priced feeding stuffs, a waste material of this composition should on no account be neglected.

Most stock will eat apple pomace readily with enjoyment. In individual cases, cows will not take to it at once, but they can easily be got to like it by introducing small quantities at a time into their ordinary ration. There are, however, certain precautions to be observed in feeding this material. In the first place, unless it has been properly preserved (a matter dealt with in the following section) it must be consumed *fresh*. As mentioned above, if left about exposed to the air the pomace undergoes a rapid acid fermentation in addition to putrefaction, and in warm weather it will be rendered unfit for food in two or three days. Secondly, very much better results will be obtained by feeding pomace mixed with more concentrated foods than by feeding it as a complete ration in itself, as is frequently done in this country. It should not form more than about one-third of the total ration.

In some districts a prejudice exists against feeding apple pomace, and it is true that if fed in too great quantities, especially when not quite fresh, some harm may result. In the case of cows, there is risk under such conditions that the milk may be tainted, and it has been reported that the consumption of very large amounts tends to cause abortion, though this has never been verified. There is, however, no risk of danger to stock if the pomace is used fresh and with reasonable moderation.

Preservation of Pomace.—The rapid deterioration of apple pomace and the necessity of feeding it whilst it is still fresh and sweet undoubtedly prevent an increase in its use as a feeding stuff. On farms and in small factories, where cider is made, the apples are all pressed during a short season in the autumn and early winter, and often more pomace is produced during this period than the stock can eat with advantage. Further, since in the cider-making districts nearly every farm has its orchard and press, little pomace can be disposed of in the locality, and it is not possible to send it any distance. Hence, any means for its preservation are of considerable importance.

* For clear explanations of these terms and their significance see the October issue of this *Journal* (Vol. xxii., p. 680).

Attention may, therefore, be drawn to the fact that pomace can be kept sweet and wholesome for a long time by converting it into a kind of silage. This plan is adopted to a considerable extent in the cider-producing districts of Normandy, but only in comparatively few places in this country.

The simplest method of making such apple silage is to pack the pomace in as fresh a condition as possible into some kind of silo. The silo may be improvised by using tubs or vats, or it may be specially constructed of masonry, or, where the soil is suitable, it may be dug out in the earth, the bottom and sides being covered with layers of straw. The pomace is pressed down very tightly in the silo—the more pressure the better—so as to include as little air as possible, and finally covered with straw and weighted in any convenient manner.

Another plan is to assist the preservation by the addition of from 5-10 per cent. of salt, giving a good sprinkling between each layer of pomace of about 1 ft. thick. By using considerable pressure, and thus keeping out the air, the whole mass becomes thoroughly consolidated, and only a very slow alcoholic fermentation takes place which does not interfere with the palatability or value of the silage. Pomace preserved in this way keeps well for a good many months and is of great value in case of scarcity of keep in the early spring.

Dried Pomace.—When dried, apple pomace is a comparatively concentrated food-stuff of much value. The process of drying cannot, however, be successfully undertaken on a small scale, and it is only in a few of the larger cider factories in this country that drying plants have recently been installed. The product is, according to report, sold to feeding-stuff manufacturers, and is employed in making compound cakes or poultry foods.

Pomace as Manure.—When for any reason apple pomace cannot be used for food it may, if properly dealt with, be turned into a very good manure. Much attention has been paid to this part of the subject in France, and a well-made compost containing pomace as its basis is looked upon as very valuable.

Ordinary samples of pomace contain from 0.2-0.6 per cent. of potash, 0.4-0.7 per cent of phosphoric acid, and 1.6-1.7 per cent. of nitrogen, so that it is richer in manurial constituents than farmyard manure. The continually increasing acidity is an objection to its direct application to the land, and in order to neutralise this it is usual to add chalk, marl or lime. This is well mixed with the pomace and some soil, and the heap is then allowed to stand for some time with occasional turning

until it is well rotted down. A good mixture would seem to be 4 parts of soil, 4 parts of pomace and 2 parts of lime.

A more ingenious device, which is frequently adopted in France, is to mix the pomace with a quantity of bone or mineral phosphates. The acid produced during fermentation is said to bring much of the insoluble phosphate present into a more readily available form, thus increasing the manurial value of both the phosphate and the pomace. In order to test this plan under English conditions, some experiments have already been started.

Pomace for Making "Small" Cider or for Improving the Quality of Low-grade Cider.—"Small" cider is made by pouring water on the pressed pomace, which has previously been broken up roughly, and allowing the moistened pulp to stand for a few hours, preferably overnight, in a wooden vessel before re-pressing. The expressed liquor is practically a diluted form of the residual juice in the pomace, and is treated in essentially the same way as pure juice for cider-making. Its quality obviously depends upon the proportion of water added to the pomace, and this should be determined by the purpose for which it is intended to use the small cider. In practice it is generally found that if water is added at the rate of 1 gal. to every 10 lb. of pomace the resulting juice possesses a specific gravity of 1010-1015. This is equivalent to a gain of 3-4 per cent. of sugar. The addition of a smaller proportion of water produces a juice of correspondingly higher specific gravity and richness in sugar. In making small cider it is well to endeavour to obtain a specific gravity of 1030 in the freshly-expressed liquor. This may be done either by reducing the proportion of added water, by expressing less of the pure juice from the pomace to be treated in the original, or by the addition of sugar. Small cider properly made is a pleasant light beverage, especially suitable for summer use on the farm.

A similar course of procedure is adopted for the improvement of inferior or tainted cider, the latter being used instead of the water for adding to the pomace as in making small cider. On most farms there is generally cider to be found which will benefit by this treatment, whether it be early-made cider from "windfalls," or acetified or otherwise tainted cider from a previous season's make. The manner in which taints in flavour are more or less completely removed by this process of "re-soaking" is very marked; and it seems probable that there is something more than a mere admixture of old cider and new juice taking place.

WOMEN'S WORK IN AGRICULTURE IN PEACE AND WAR.

By an interesting coincidence two official publications were issued in November relating to the employment and education of women in agriculture, one concerned with normal times* and the other with the present emergency.† A study of these documents will prove instructive both to the farmer and the educationist, and will probably lead to the conclusion that had it been possible in years of peace to carry out the recommendations made in the former it would not have been found necessary during the war to improvise methods in the manner suggested in the latter. It is proposed here first to review these publications, and then to give an account of the experiences of some farmers who have recently engaged women to take the place of men who have joined the forces.

Report of the Agricultural Education Conference.—The Board of Agriculture and Fisheries, some time before the outbreak of war, decided to refer to the Agricultural Education Conference the question of agricultural education for women. The enquiry was actually undertaken during the first six months of the current year, but the subject was looked at principally from the point of view of normal requirements without direct reference to the war. The Conference considered that the system of agricultural education in this country has been built up mainly to meet the requirements of men; and that, with very few exceptions, the instruction available for women consists of (1) courses in men's institutions which admit women students; and (2) additional short courses or classes for women, which are attached to institutions for men.

Rural Women.—In considering the education required for the wives and daughters of agriculturists (who constitute the great majority of rural women) there are two aspects to be remembered: one is how to make women do better the work in which they are locally engaged; the other is how to arouse interest in and initiate new forms of work which could profitably be carried on. As conditions often vary in different parts of the same county, the Conference were of opinion that the system of teaching must be elastic; that it must be brought

* Report of the Agricultural Education Conference on Agricultural Education for Women. Messrs. Wyman & Sons. Price 1s. 3d.

† Circular Letter to the Secretaries of the County War Agricultural Committees on the Employment and Training of Women (A 250C and Memorandum).

to the doors of the women concerned; and that, while any scheme of instruction should in its main features be applicable to the whole country and to both sexes, the particular needs of women should be considered and their wants supplied.

The facilities offered to rural women consist of itinerant instruction, and in a few counties short courses at a farm school or similar institution. As the former is, however, the only method by which the great majority of the wives of small holders and cottagers can be reached, the Conference considered that the amount of instruction at present provided is totally inadequate. They also expressed the opinion that itinerant instruction should take the form of organised classes rather than lectures, especially in the case of poultry-keeping and horticulture. As regards farm schools it is pointed out that while there are twelve institutions which may be considered as coming under this head, the extent to which they provide agricultural education for women is very limited. Only two, in fact, attempt to teach any part of the practical side of agriculture in addition to dairying, and, therefore, fulfil the function of real farm schools. One may say, therefore, that except in the case of indoor dairy work there is practically no instruction in agricultural work offered to young women of the tenant farmer or small-holder class at any fixed institution. The Conference fully endorse the policy of the Board of Agriculture and Fisheries in encouraging the provision at fixed institutions in each county of courses suitable to the conditions of the district, and recommend that the curriculum provided for girls should include instruction in the care of animals, the minor farm processes, and domestic economy, including fruit-bottling and jam-making.

With regard to instruction in domestic economy, it is to be observed that while in Ireland, Belgium, and Canada instruction in home management forms the central feature of the agricultural education provided for women, and aims at improving the work of rural women in the home, no less than the farm and garden, in this country the facilities offered to rural women have, almost without exception, been restricted to courses of instruction and lectures in technical agricultural subjects, such as dairying and poultry-keeping. The Conference recommend that instruction in home management should be provided for women in any grouped course of agricultural education.

Women of the Professional Classes.—Another class of women requiring agricultural education includes women belonging to

the professional and land-owning classes, and the daughters of the larger farmers. They are drawn from the towns as well as the country, and take up this work as a definite profession from choice and not necessarily because they are born into it. For a woman of this type it is desirable, whether she intends to become a teacher or undertake a post involving management, that she should have some experience on the practical side. At an agricultural college male students get this form of training, not only in the actual processes of farm work, but in estate management, surveying, etc. While it is generally agreed that manual work should not form any large part of a college curriculum, it must be remembered that in the case of farmers' sons they can acquire knowledge of such work at their own homes, and that the sons of professional men who have had no previous experience are advised to gain their practical knowledge on an ordinary farm before coming to college. In the case of women, the proportion who have had no experience on the practical side is relatively large. For them, both in agriculture and horticulture, there have been definite difficulties in getting instruction on farms and gardens run on commercial lines. It is more essential, therefore, in their case that colleges should offer opportunities for learning the actual technicalities. It is for this reason that, in the instruction provided in the women's colleges at Swanley and Studley, practical work in horticulture takes a foremost place. An institution is badly needed in which women can learn the processes of agriculture which a farmer's son learns normally at home.

While the Conference consider that the absence of facilities for women analogous to the combination of practical and theoretical instruction provided for men at certain agricultural colleges indicates a definite want, they do not advocate the increase of the number of institutions of the collegiate type, but recommend that there is room for the provision, at one or more of the institutions, whether entirely devoted to women or not, of a systematic course in general agriculture, comprising both the practical and scientific side.

Action by the War Agricultural Committees.—From the above paragraphs it can easily be imagined that the system of agricultural education for women, inadequate for normal times, was quite incapable of meeting the demand brought about by the war for a large increase in the facilities for training women to undertake farm work. On this subject the President of the Board has addressed a circular letter to the War Agricultural

Committees and the Local Education Authorities, from which the following paragraphs are quoted :—

The question [of the employment of women in agriculture] has received the attention of the Departmental Committee on the Home Production of Food, who have recommended in their Final Report (Cd. 8095) that the War Agricultural Committees should organise an appeal to women living in their areas to offer their services to local farmers. Lord Selborne approves of this recommendation, and he thinks it is probable that there are many women qualified to undertake some branch of farm work, such as milking, who are not at present employed in agriculture and not aware that their services are required. Some of these might, if appealed to on patriotic grounds, be able in the present emergency to undertake farm work of a certain type. His Lordship, therefore, hopes that your Committee will arrange that women throughout the county be canvassed with a view to ascertaining the number in each parish willing and qualified to engage in agricultural work. In counties in which courses in buttermaking and cheesemaking have been held for some years the County Agricultural Staff could probably supply the Committee with a list of past students known to be efficient milkers and dairy-women, and Lord Selborne suggests that your Committee should take steps to secure that all such women are informed that there is a serious shortage of skilled farm workers and that their services would be greatly appreciated.

The Departmental Committee expressed the opinion that it is essential that farmers should offer efficient women workers a fair wage. Lord Selborne considers that it will be impossible to maintain the supply of woman labour for farm work unless an adequate wage is offered, and he trusts that your Committee will bring this to the notice of farmers employing women in your area.

Lord Milner's Committee further took the view that for women unacquainted with farm work some course of practical instruction is necessary, and they suggested that county committees might make provision for training women in their areas similar to that which has been made by certain local education authorities. The experiments which have been made in a few counties since the outbreak of war in training women for farm work have proved that it is possible, by providing selected women with short courses of training, to make an appreciable addition to the number of farm workers available at the present time. Lord Selborne has therefore had prepared, for the information of your Committee, a memorandum describing the methods adopted in different parts of the country with a view to fitting women to undertake farm work, and he trusts that your Committee will co-operate with the Committee responsible for agricultural education in your county in the preparation of a scheme for this purpose.

It will be seen that, in the case of the scheme initiated by the Board, out of 218 women who took a course of training of from two to four weeks, 199 are at present in agricultural employment. These women were all selected by the Labour Exchanges, and most of them had no previous knowledge of agricultural work. There is good reason to believe that similar results could be obtained in each county in England in which there is a farm school or agricultural college at which the training could be given. Where there is no such institution the county committees should consider the possibility of arranging for pupils to be housed at a farm on the lines followed in Nottingham. In this case,

however, Lord Selborne suggests that the farmer on whose land the women are to be instructed should be asked to nominate one of his regular employees to act as instructor, and that a small payment of, say, sixpence a day should be made to the instructor from county funds. In this way any opposition to imparting gratuitous instruction may be overcome.

The two schemes mentioned provided for the women being brought from a distance and housed at the place where the training was given. A much larger number of women can be dealt with if the course is not residential, and this is an advantageous feature of the scheme carried on with so much success in Cornwall. A scheme of that nature, however, would be successful only if the following essential conditions could be secured: (1) a number of efficient women farm workers available throughout the county to act as instructresses, and (2) great energy and patriotism on the part of the members of the County Committee and the Women's Committees formed in every parish.

In the light of this information, Lord Selborne confidently hopes that he will secure the co-operation of your Committee in initiating and carrying out the necessary measures for the employment of women in farm work in your area, and I am to suggest that the canvass of women in your area should be taken in hand immediately. If, as is probable in some counties, the number of local women available for agricultural work is found after the canvass is completed to be insufficient, the Committee should take steps to augment the number by obtaining through the Labour Exchanges women from neighbouring towns who are willing to undergo a short course of training on the lines already described.

I am further to say that any approved expenditure which the Local Education Authority incur in providing such instruction will be eligible for grant under the Board's Regulations.

War Measures.—The memorandum referred to in the above extract describes the experiments which have been made in different parts of the country since the outbreak of hostilities in the training of women to meet the shortage of labour on farms. It was realised soon after the outbreak of war, that in order to replace men withdrawn from agriculture for service in the military forces, it would be necessary to provide instruction, in some of the lighter branches of agriculture, for women who, hitherto, had had little or no experience of farm work. Further, it was evident that if a considerable number of women were to be dealt with it was impossible to provide them with prolonged courses of training. The object to be aimed at, therefore, was (1) in the case of women entirely unacquainted with agriculture, to give them an opportunity of becoming familiar with farm work (especially in association with other women), and thereby gaining some confidence in themselves before seeking employment as wage-earners; and (2) in the case of women already familiar with farm work, to provide them with opportunities of extending their knowledge and increasing their efficiency.

To meet these objects the following three methods have been tried :—

Cornwall County Council's Scheme.—The object of the Cornwall Agricultural Committee and Sub-Committees was to organise a systematic and personal appeal among local women to offer their services to farmers, not merely in order to relieve the existing shortage of manual labour, but to ensure that still more men might be released for the military forces. This object was accomplished by the formation of Women's Committees for each parish in the Education area, the members of which were responsible for a local canvass, the compilation of a register of women willing to work on the land, and the selection of a number of capable women competent to act as instructresses. These local instructresses were responsible for classes in such subjects as milking; the preparation of cattle foods; and feeding calves, pig and dairy cattle. More advanced instruction in dairy work, if required was undertaken by the regular County Staff Instructress. Classes by the local instructresses were also held in other branches of farm work such as hoeing roots, harvesting hay and corn, lifting potatoes, weeding and gardening.

The usual arrangements were for a farmer who had an efficient dairywoman to place her and the required number of cows at the disposal of the parish committee. Similarly, a farmer would allow a competent woman to hold a class in turnip hoeing, or any other branch of light farm work, on his land. The farmer was required to continue to pay the instructress her regular wage, and she received, in addition, sixpence a day from county funds. In this way the number of women capable of working on the land was increased at very little cost to public funds. One feature of the scheme which should be mentioned was that the services of women unable to undertake farm work were also enlisted so as to relieve those women, who left their homes to work in the fields of a part of their home duties, by mending the family's clothes, by cooking the dinner, &c.

For further information regarding the Cornwall scheme reference should be made to a pamphlet on the subject written by Mr. W. Hawk the Chairman of the Agricultural Committee of the Cornwall County Council.*

Nottingham County Council's Scheme.—The Nottingham County Council Advisory Labour Committee arranged for eight women at a time to be housed at a farm-house in the county. The farmer allowed his farm to be used for the purpose free of rent, and gave a donation and weekly subscription towards general expenses. The women were selected by the Labour Exchanges from a large number of applicants and the course of training lasted three weeks. Two courses were held. Four of the women worked on the central farm and four on two neighbouring farms. The farmers in each case arranged for the instruction to be given, and gave the women their breakfast and dinner in return for the work done. The voluntary services of a matron superintendent were obtained to supervise the working of the scheme and the assistance of the County Agricultural Organiser and the instructor in Agricultural Processes were also secured.

* "Suggestions for the Assistance of Women's Committees appointed to organise the Labour of Women and Girls of Cornwall who are willing to help in Agricultural pursuits during the War." Published by the Cornwall County Council.

The pupils were given instruction in milking both mornings and afternoons, and they also assisted with calves, pigs and poultry, hay-making, root singling and hoeing, top dressing with artificials, cleaning and whitewashing cowsheds, gardening and pea picking. The course of instruction was too short to give a thorough training to the pupils, most of whom came from semi-urban districts and had no previous knowledge of farm work, but it enabled them to get accustomed to rural life and conditions, and gave the Labour Exchange an opportunity of judging of their ability to take situations which farmers had applied to them to fill. It is understood, however, that owing to the housing difficulty, and for other reasons, it was not easy to find suitable places for the women trained.

Scheme carried out by the Board of Agriculture and Fisheries through certain Colleges and Farm-schools.—The Board of Agriculture and Fisheries arranged with the Labour Exchanges and certain agricultural colleges and farm-schools, situated in different parts of England and Wales, for the training of a number of young women, who were willing to accept employment as milkers and to undertake light farm work. The Board undertook the payment of the pupils' traveling expenses as well as of their board, lodging and tuition at the institution. The women were selected by the Labour Exchanges, who undertook to place the women out on farms on completion of their training.

The scheme was in operation for 25 weeks and the women selected were in nearly every case without previous experience of agricultural work, many coming from urban employment. The length of the course varied from 2 to 4 weeks. In all, 218 women were passed through the course of training and of these 199 were placed in employment, and, so far as is known, are working satisfactorily. In an emergency scheme of this kind mistakes were inevitable, and a few unsuitable women were selected. It is also admitted that the two-weeks course was too short. But the figures given are alone sufficient to justify the statement that the scheme, regarded as an experiment, was successful. Moreover, much prejudice on the part both of the women themselves and of farmers has been overcome.

The difficulty experienced in placing the women after training varied greatly in different parts of the country. But recently the Labour Exchanges have reported an increasing demand for efficient women for employment by farmers, especially capable milkers. The wages received by women trained under the scheme varied from 5s. to 10s. weekly when board and lodging were provided, or from 14s. to 20s. weekly when they lived out, cottages and perquisites being provided in some cases.

Examples of the Employment of Women.—The following are examples of the experiences of farmers in the employment of women during the last sixteen months :—

(1) The farmer has about 100 milking cows, about 75 of which are usually in milk at the same time. In addition to these, the farm carries about 70 young stock. The labour hitherto required to carry on the dairy work efficiently has necessitated the employment of eight men and one dairy maid. At the outbreak of the war four of the men offered to enlist; two were accepted; the other two were at first refused but subsequently one of them was accepted. The

places of two of the men were filled with other men on the farm who could milk.

There were then available for the work of the farm one dairy maid and seven men, and these succeeded in carrying on the work by working overtime. Later on the farmer arranged with four young ladies that they should be employed in the dairy. These young ladies, housed in a cottage, do all their own housekeeping and cooking, and are treated in every way as the other employees. All four are in the dairy at 5 a.m., and milk till 8 a.m. One of the four spends five hours of the morning and afternoon in the milk room washing up bottles and being of assistance to the milkmaid, work formerly done by one of the men; the other three again milk from 2 till 5, and two of these three wash out the cow-barn and do odd jobs from 9.30 to 11.30. The remaining one stays at home and does the housework and cooking. Each one spends one week in the month in the milk room, and each one spends one week in the month doing the housework and house-keeping. The result is that three work for eight hours a day for seven days, and one works for six hours a day for seven days; one weekly half holiday is given in the same way as to all employees on the farm. In addition to this, each man or girl in the dairy gets one Sunday off in every seven.

These ladies had not previously lived on a farm; within three weeks each was milking her own share of the total number of cows in the dairy, and doing 10 or 11 cows as required in the afternoon when any one of the men was away. They do the work as well as the trained men. As soon as these ladies were competent, the two men who had been temporarily employed on milking returned to their ordinary farm work. The farmer now has one more milker than he has had since the war began, and in consequence he is enabled to increase the number of cows that he milks, and, therefore, the amount of food that is produced.

(2) A large farmer in the South of England had his staff reduced by 14 men, and engaged five women. He reports that they are doing his dairy work well, and that the calf-rearing is being better attended to than before. He is anxious to obtain the services of two further women.

(3) A dairy farmer having 200 cows engaged two women to take the place of men. He found these so successful that he has now five women in his employment.

Another example of women's work in agriculture (in this instance in fruit growing) illustrates both the public spirit and the ingenuity shown by country women at the present time. The owner of a garden, scheduled under the American Gooseberry Mildew Order, was called to the Colours when the Army was mobilised in August, 1914. His daughter was left to carry out the requirements of the Order by herself. Finding that she could not get the diseased shoots removed in time, she put up a notice explaining her position and asking for voluntary help from ladies. The number who offered their services was more than she could employ. The work was rapidly carried out, and the Board's Inspector reported that "the garden was well tipped."

THE SELECTION OF WHEATS FOR SPRING SOWING.

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WHEN it has proved impracticable to sow the whole of the land intended for wheat during the autumn months, the first possible opportunity for carrying out the work is usually taken in the spring.

As a rule, both the soil and weather conditions are unfavourable during January, and the operations have to be delayed until February. If sowing can be done early in the month the loss of a week or two of the winter is not very serious, for, owing to the slow rate of germination at the low temperatures usually prevailing then, the later-sown crops may catch up with those sown a little earlier. If, however, the sowing of the crop cannot be carried out before the middle of February, some consideration must be given to the variety of wheat which is to be sown. Up to this date it is reasonably safe to sow any of the ordinary autumn wheats. A week or so later such a course is decidedly risky; it may result in a moderate crop or it may fail to produce any crop at all. In the best of circumstances the crop may ripen so slowly that harvesting is impracticable until a month, or even more, after the normal date. Such a crop is especially liable to be destroyed by sparrows, and it may have to be cut, even if unripe, in order to save a portion of it. In the second case the plants grow vigorously throughout the spring, but instead of coming into ear at the end of May or in June they continue to produce quantities of foliage, and either no ears at all or far too few to yield a paying crop.

It is impossible to state precisely the date before which any given variety must be planted in order to prevent the crop from "running." It probably varies with climatic conditions as well as with the kind of wheat sown. As a generalisation one may safely say that the slowest-maturing wheats, such as Rivett's, require to be planted at an earlier date than moderately rapid-maturing wheats such as Square-head's Master, whilst a fast-growing wheat such as Nursery may safely be sown at a still later date. Judging from the experience of last season, when an unusually large area of

wheat was spring-sown, two of the safest of the autumn wheats for sowing up to the end of February are Squarehead's Master and Little Joss. In fact both of these were sown on several occasions in March with satisfactory results. Such a course entails a considerable amount of risk, and it cannot be generally recommended. For March planting, or even for planting after mid-February, one of the rapidly-maturing spring wheats should be chosen. Some of these, especially if sown early in the year, yield as well as the late-sown autumn wheats, and the crops can generally be harvested at about the usual dates. Further, they can, if necessary, be sown still later in the season. One or two may be planted throughout April or even well into May with the certainty of securing a crop, though very late sowing means some delay in harvesting. It is, however, unwise to make too much use of this valuable characteristic, for late sowing is usually accompanied by a marked diminution in the yield of the crop.

Varieties of Wheat for Spring Sowing.—The varieties of wheat especially suitable for spring planting are April or April Bearded, Nursery, Red Marvel, Dreadnought, Red Fife, Burgoyne's Fife and Marquis. All of these may, if necessary, be sown after the middle of February, whilst some of them may be sown, with a reasonable certainty of securing a crop, as late as the end of April.

April, or April Bearded, is one of the most reliable wheats for late sowing. In most districts it may be planted with perfect safety up till the middle of April, and even when sown at so late a date the crop may be harvested soon after that of the autumn-sown wheats. Earlier planting is advisable, however, in order to give the plants an opportunity to tiller more freely.

The ears of this variety are slender, lax and bearded, red or reddish-grey in colour; the grain is red and appears to be slightly better in quality than that of most English wheats. The straw is slender and rye-like, but rarely abundant, owing to the deficient tillering capacity of the plants.

In purchasing this variety it is as well to enquire for April Bearded wheat in order to prevent confusion with Red Marvel, a beardless wheat occasionally substituted for it.

Nursery Wheat is an old English variety suitable either for autumn or spring sowing. It can usually be counted upon to ripen satisfactorily if sown before mid-April, but it is not so reliable for extremely late planting as April Bearded. When

sowings can be made in March it should be chosen in preference to April Bearded, as it usually produces a better crop.

The ears are broad, moderately dense and well set, with a pale, beardless chaff; the grain is red and better in quality than that of most of our wheats. The difference in strength, however, is not sufficiently great to warrant the millers in paying more than a few pence per quarter extra on this account.

Red Marvel, also known as *Red Admiral*, is a variety imported some years ago from France, where it is grown under the name of Japhet. It is a valuable wheat for early spring sowing, but, as a rule, it should not be planted later than the middle of March.

The ears are fairly large, somewhat lax, beardless, and of a dull white colour; the grain is red and distinctly poor in quality. The straw bends over as the crop matures and it is frequently discoloured and soft owing to the readiness with which the plants are attacked by rust. In spite of these obvious faults the variety can be recommended on account of its large crops of grain. These, from early sowings, may almost equal those of the autumn-sown wheats, but any delay in planting is followed by a very marked diminution in the yield.

Dreadnought (Hâtif Inversable), another wheat of French origin, is suitable for sowing not later than the end of February. It has relatively short, strong straw, which fits it admirably for sowing on rich, deep land. The ear is large and dense and the grain is of medium quality.

Red Fife, *Burgoyne's Fife* and *Marquis* form a group of wheats particularly suitable for spring sowing in districts where wheat of this type is known to do well. Their grain is of excellent quality and should command prices which would go far to make up for any deficiency in yield. A well-grown and well-harvested sample of Red Fife should command much the same price as the best of the wheat imported from Canada, since it can be used for blending or for the manufacture of the highest grades of flour in precisely the same manner as the Manitoba Hards.

Red Fife may be sown at any time from October to the end of April, but, judging from an analysis of the results of many experiments, sowings made in February give, on the whole, the best results. Nevertheless cases are on record of crops of 6 qr. to the acre from April sowings. Such a high

yield, however, is unusual ; about 30 bush. per acre would generally be considered a good crop.

The heaviest crops recorded are from light, loamy soils, from soils overlying chalk, and from brick earth. Good average crops are also frequently grown on light, sandy soils. The cropping capacity, however, is very uncertain, and it is impossible to state very definitely the conditions which suit this wheat ; consequently, advice on this point should be sought from the nearest experimental station, and, if the variety has not been tested locally, sowings should only be made on a small scale.

The ears are small, lax, beardless, and white in colour ; the grain is red and almost always translucent, hard, small, and of high bushel weight. The straw is slender, and apt to be brittle if over-ripe, but generally stands satisfactorily.

In the West Midland counties a somewhat impure stock of this wheat has been grown for the last twenty years under the name of Cook's Wonder.

Burgoynes's Fife resembles Red Fife in its general appearance, but the straw is stiffer, the ears are usually a little larger, and the variety is, as a rule, a better cropper. The grain, however, is white in colour, and, though much better in quality than that of ordinary English wheats, it is not so "strong" as that of Red Fife. The variety is best sown early in the spring.

Marquis wheat is a recent importation from Canada which has been considerably recommended for spring sowing. At present it has not been tested sufficiently in this country for any real opinion as to its value to be formed. In most respects the variety is very similar to Red Fife, but it is capable of maturing in an even shorter period than that variety. Its yielding capacity appears to be about the same as, or possibly a little less than, that of Red Fife. The stocks grown in this country are far from pure, but as the "rogues" ripen at about the same period as Marquis the admixture is not particularly serious.

Very few comparative trials of the yielding capacity of these various spring wheats have been made up to the present, and although a large number of isolated records of yield are available they cannot be averaged fairly for purposes of comparison. The figures vary from 18 to 50 bush. per acre, or even more, but the differences are largely accounted for by variations in the date of sowing. Nevertheless the returns indicate that where wheats of the Fife class are known to succeed they should be sown in preference to any others. If

there is any doubt on this point, Dreadnought should be chosen for the earliest sowings, say until the end of February, either Nursery or Red Marvel for sowing until the middle of March, whilst April Bearded or, possibly, Marquis, should be selected for any later sowings.

Rate of Sowing.—Spring wheats must usually be sown a little thicker than autumn wheats. From 3 to 4 bush. per acre is the usual rate for drilling. As a rule, the earlier the sowing, the better the preparation of the seed-bed, and the richer the land, the less will be the quantity of seed required.

Manuring.—Unless the land is highly fertile, a dressing of $\frac{3}{4}$ to 1 cwt. of sulphate of ammonia and 2 to 3 cwt. of super-phosphate per acre, should be applied at seed time, with the two-fold object of encouraging growth and hastening maturity.

NEW FEEDING STUFFS.

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DURING the past year the prices ruling for meat and dairy produce have been abnormally high. This state of affairs is chiefly due to two main causes :

- (a) The greatly increased cost of cattle foods.
- (b) The increased consumption of meat.

One of the most effective means of reducing the cost of feeding would be to introduce on a considerable scale certain new and cheap feeding stuffs which in the past have been extensively used in other countries but which, up till now, have scarcely been known in this country.

India, Egypt, and other British possessions and protectorates grow large quantities of oil-bearing seeds which are little known in this country. After the extraction of the oil from the seeds the residue is made into cattle cakes, the feeding value of which is often very high. Examples of such seeds are Sesame seed, Niger seed, Safflower seed, and Ground nut.

Sesame Seed (Sesamum indicum) and Sesame Cake.

Sesame is an annual plant grown extensively in all the tropical regions of the globe. In India it is more generally grown as an autumn or winter crop in the tropical districts, and as a summer crop in the colder parts. In 1912-13 the estimated area in British India under Sesame was 4,164,045

acres, yielding 471,700 tons of seed. As the following table shows, the export of Sesame from the various tropical countries is considerable :—

	<i>Export.</i>	<i>Tons.</i>	<i>£</i>
India (1913)	112,200	1,797,000
China (1913)	121,110	1,869,000
Turkey (1912)	12,000	—
Africa and Indo-China (1912 and 1913)	...	15,469	225,500
		<u>260,779</u>	<u>—</u>

Practically the whole of the seed exported from India found its way to Continental Europe, viz., Germany, Belgium, France, Italy, and Austria-Hungary. The following table shows the exports to these countries from India in the year 1913-14, and the total imports into several of these countries in 1913 :—

—	Exports from India, 1913-14.	Total Imports, 1913.
	<i>Tons.</i>	<i>Tons.</i>
France	22,207	27,370
Belgium	33,779	—
Germany	16,510	114,174
Austria-Hungary	19,342	26,201
Italy	14,293	—

Very little Sesame seed was imported into the United Kingdom ; a serious position has been brought about in the trade in Sesame seed from our Colonies and Possessions (especially India) as a result of the closing of German, Austrian and Belgian markets.

There are two easily recognised forms of sesame, one with black seeds and the other with white. The black seed form yields the best oil. The oil is obtained by expression in mills by the same process as that employed for extracting mustard oil. It has no smell and is not liable to become rancid. In India it is used largely for culinary purposes, anointing the body, in soap manufacture, and as a lamp oil. In many of its properties sesame oil resembles olive oil, and is similarly used. It is also extensively used in the manufacture of Indian perfumes.

Sesame Cake is very rich in protein and oil, and is widely used on the Continent as a substitute for linseed cake for milk production and for fattening all classes of stock. ; 2½ lb. of sesame cake are roughly equivalent to 3 lb. of linseed cake. The cake is said to cause softness in the butter, and German

experience seems to indicate that it is liable to become mouldy and rancid if not carefully stored.

Various analyses of sesame seed and cake are given in the following table :—

—	Seed. Kellner.	Cake. Kellner.	Cake. Chelmsford (French manufacture).	Cake. Chelmsford (English manufacture).
	Per cent.	Per cent.	Per cent.	Per cent.
Moisture ...	5.5	9.5	8.5	9.3
Oil ...	47.2	12.6	11.1	11.9
Protein ...	20.5	39.8	37.7	44.5
Sol. Carbo- hydrates	15.0	20.6	16.8	20.9
Woody Fibre ...	6.3	6.8	17.1	4.5
Ash ...	5.5	10.7	8.8	8.9
	100.0	100.0	100.0	100.0

The above analyses of sesame cake are superior to the analysis of an average sample of linseed cake, and compare very favourably with that of decorticated cotton cake.

As regards digestibility and palatability, sesame cake is equal to the best cakes at present on the market. According to Kellner, 77 per cent. of the organic matter, 90 per cent. of the crude protein, 90 per cent. of the crude oil, 56 per cent. of the carbohydrates, and 31 per cent. of the fibre are digestible.

Digestible Constituents in Sesame Cake.

—	True Protein.	Oil.	Sol. Carbo- hydrates and Fibre.	Starch Equivalent
	Per cent.	Per cent.	Per cent.	Per cent.
Kellner ...	34.2	11.3	13.6	71.0
French Manufacture (Chelmsford)	32.3	10.0	14.7	66.7
English Manufacture (Chelmsford)	38.4	10.7	13.1	72.7

Manurial Value.—The cake contains 7.12 per cent. nitrogen, 2.6 per cent. phosphoric acid and 1 per cent. potash. The compensation value for each ton of the food consumed, according to Hall and Voelcker's system (1914), is—

62s. 3d. for the year of application, and

31s. 1½d. for the following year.

Niger Seed (Guizotia Abyssinica) and Niger Cake.

Niger seed belongs to the order *Compositae*. The seed is a native of tropical Africa, but it is cultivated as an oil seed in most of the provinces of India.

The seed is rich in oil, yielding about 16 gal. per quarter of seed. The oil is pale yellow or orange in colour with little odour and a sweet taste. In its drying properties it ranks between cottonseed and linseed oil. Commercially the oil is used for making paints, anointing the body, to a certain extent for cooking, and as an adulterant of the more valuable oils. Niger seed oil is reputed to be of use in cases of fracture and dislocation of bones among cattle.

The cake which is left after the oil has been extracted from the seed is used for cattle feeding, for which purpose, in India and elsewhere, it is greatly appreciated. Several samples of the cake have in past years found their way into Essex, and an average analysis of five of these samples is given below. As far as can be ascertained, the Essex farmers who used this cake seemed quite satisfied with the results they obtained.

		Niger Seed. 1 sample (Chelmsford). Per cent.		Niger Cake. Average (Chelmsford). Per cent.
Moisture	...	5.09	...	10.4
Oil	...	38.46	...	6.1
Protein	...	23.10	...	33.1
Sol. Carbohydrates	...	12.65	...	23.4
Woody fibre	...	15.58	...	16.8
Ash	...	5.12	...	10.2
		100.00	...	100.0

The percentages of fibre and the ash in the cake are somewhat high, but no doubt if the seed were crushed in this country the amount of these constituents could be materially reduced.

Digestibility.—R. Gouin, in "Alimentation Rationnelle des Animaux Domestiques," records that the cake contains 26.5 per cent. digestible protein, 3.3 per cent. digestible oil and 24.0 per cent. digestible carbohydrates. According to Kellner the corresponding figures are 25.6 per cent., 4.4 per cent., and 18.8 per cent. respectively.

Manurial Value.—Niger cake contains 5.30 per cent. nitrogen and 1.72 per cent. phosphoric acid. The compensation value per ton of the cake consumed would, therefore, be—

43s. 7d. for the year of application, and
21s. 9d. for the following year.

Safflower Seed (Carthamus tinctorius) and Safflower Cake.

Safflower is grown extensively, amongst other places, in India, China, and Egypt. In India it is grown both for its flowers—the Safflower dye of commerce—and for its oil-yielding seeds.

The oil seed crop is grown to the largest extent in the Bombay Presidency where the area is usually 500,000 to 600,000 acres. Figures for the other provinces of India do not appear to be available. The seeds from the dye-yielding plants are also collected and form a supplementary source of safflower seed oil.

Two different processes for extracting the oil are in vogue. In the one the seeds are submitted to cold dry pressure either before or after husking. The second process consists of a hot dry extraction, or crude downward distillation. The yield of oil from the first method varies from 20–30 per cent. The oil is clear and light in colour, possesses pronounced drying properties, and is useful as a lamp oil and for culinary purposes. It readily saponifies with alkalies, and the free fatty acids obtained resemble linoleic acid obtained from linseed.

The amount of oil obtained by the hot extraction process varies from 25 to 37 per cent. This oil, however, is useless for both burning purposes and for food.

Voelcker, in the "Standard Cyclopedia of Modern Agriculture," gives the following compositions for the two kinds of Safflower cake:—

	Safflower Cake.		Safflower Seeds
	Decorticated (Voelcker).	Undecorticated (Voelcker).	Unhusked (Chelmsford).
	Per cent.	Per cent.	Per cent.
Moisture	11.60	8.55	6.58
Oil... ..	7.70	9.73	25.67
Albuminoid Compounds	47.88	20.25	13.65
Sol. Carbohydrates ...	19.72	25.12	20.40
Woody Fibre	6.20	32.95	29.53
Ash	6.90	3.40	4.17
	100.00	100.00	100.00

Mollison records that cattle have to be educated to eat the cake, but that it has the advantage of keeping well and does not get mouldy. The cake is highly valued as a manure.

Earth Nut or Ground Nut Cake.

An account of this feeding stuff has already appeared in this *Journal* (July, 1915). The article indicates that it is a very

desirable feeding stuff and might be more widely used by the farmers of this country. The extent to which this is possible will naturally depend upon the available supply. In this connection it is interesting to note that the estimated production of ground nuts in British India has steadily increased from 94,419 tons in 1903-4 to 631,400 tons in 1912-13. Mollison says "a good crop on suitable land liberally managed will, on an average, yield from 3,000 to 3,500 lb. per acre." In 1906-7 the "foreign export" of ground nuts from India was 95,000 tons and in 1913-14 278,000 tons. French West Africa is the second largest exporter with an export of 188,000 tons in 1912, Gambia third with 67,000 tons in 1913; Nigeria exported 19,000 tons in 1913.

In 1913 France imported 523,000 tons of ground nuts and Germany 96,000 tons. The imports of ground nuts into the United Kingdom are known to be small.

Great progress in the cultivation of ground nut is being made in India by the introduction of new seed, and there is no reason to suppose that a steady supply of ground nuts will not be available for this country.

Prior to the war several Essex farmers had tried ground nut cake, obtained probably from France. Enquiries have elicited the information that in every case the farmers using the cake were very pleased with the results obtained.

The average analysis of six of these samples is as follows :—

	Per cent.
Moisture	9.5
Oil	7.3
Albuminoids	47.0
Sol. Carbohydrates	24.9
Woody Fibre	5.8
Ash	5.5
	<hr/> 100.0

It is held by some that ground nut cake has a tendency to become rancid. The liability in this respect, however, is not nearly so great as in the case of coconut cake.

The supply of these new cattle cakes at a reasonable price depends mainly on the willingness of the seed crushers in this country to crush the seeds. The writer has been in communication with a number of British seed crushers, with the object of finding out whether in their opinion the extraction of oil from any of the above seeds, and the manufacture of feeding cakes from the residues, could be carried on extensively in this country.

There seems to be a general consensus of opinion amongst seed crushers that this country could certainly compete suc-

cessfully with Continental states. The seed crushers point out, however, that they are under one great disadvantage. Whereas Continental seed crushers can readily find a market for the residual cakes, they cannot. They complain that it is difficult, if not impossible, to induce the British farmer to try any new feeding stuffs, and that, therefore, all their residual material has to be sold at a poor price for the manufacture of compound cakes. It is certainly curious and unfortunate that the British farmer will not buy, for example, sesame cake itself, but is perfectly willing to purchase it as a compound cake.

There is reason to suppose that large quantities of sesame seed and ground nuts are a glut on the Indian market at the present time. The excellent feeding value of the respective cakes has been established in practically every Continental country. Although elaborate feeding experiments would supply very interesting information respecting the relative feeding values of these cakes, there is no time at this stage for these. Sufficient data already exist to show that these feeding stuffs can be safely and advantageously employed in the feeding of all classes of milk and fattening stock. There is little doubt that the employment of these new cattle foods in this country would, in addition to reducing the cost of production of meat and milk, be a great step towards securing for the country an industry which, though connected intimately with our own possessions, has largely been centred on the Continent, particularly in Germany.

Reference : " The Commercial Products of India," by Sir George Watt.
Many of the recent statistics have been supplied by the Commercial Intelligence Department of the Board of Trade.

THE SELECTION OF POULTRY FOR BREEDING STOCK AND THE HATCHING OF CHICKENS.

AMONG the annual operations connected with poultry-keeping none is more important than the selection of stock for breeding, and the hatching and rearing of chickens.

Selection of Breeding Stock.—Whether chickens are required for table purposes or for egg production, it is a mistake to gather eggs for hatching indiscriminately from a large flock of fowls. A selection should be made of the most suitable birds. These should be separated from the rest of the flock, and either kept on a free range or in a run large enough to allow 20 sq. yds. for each bird. The run should be erected on untainted soil.

The birds to be placed in the breeding pen should be in perfect health, *i.e.*, they should not only be free from disease, but they should show vigour and activity. A little careful observation will soon enable the poultry-keeper to select the most suitable birds; health and vigour are indicated by the appearance of the eye, comb, and head, by the condition of the plumage, and by a certain pugnacity and tendency to range freely. Whatever kind of hen is chosen, the male bird should always be pure bred. Birds which are known to have suffered from disease should be excluded, even if they appear to have recovered completely.

Selection for Egg Production.—Judgment guided by the eye alone is not likely to be satisfactory where the object is to increase egg-production; it is necessary to know, so far as possible, which birds have laid best. If trap nests are not used the actual records of the hens will not be known, but it may be possible to select those which as pullets began to lay during October or November. A large proportion of such birds prove to be good layers. The birds chosen for the breeding pen should be hens which have actually proved themselves to be good layers, or *well-matured* pullets which have been bred from high-yielding hens.

In selecting a male bird to mate with hens or pullets it is very important to obtain a bird which has been bred from a hen known to be a good layer. The results of extensive experiments, as well as the general opinion of experienced breeders, indicate that the male bird is largely responsible for transmitting the capacity for high egg production, and it is important, therefore, to ascertain that he is bred from carefully selected stock.

Selection for Table Purposes.—A pen formed for the purpose of breeding table chickens should consist of birds of a recognised table breed or breeds; the individual birds chosen should possess good breast development, white flesh and legs, and small bones.

Age of the Stock.—As a general rule, two-year-old hens should be mated with a cockerel, while pullets should be mated with a cock. A cock retained for breeding should be separated from the hens during the moult. He should be generously fed both for a few weeks before and during the growth of the new feathers. Under exceptional circumstances very early hatched (January or February) cockerels may be mated with pullets. The cockerel must be pure bred and at least a month older than the pullets.

Number of Birds in the Breeding Pen.—The number of birds to be included in the breeding pen must be determined by the breed, the season of the year, and, to some extent, by the range available. In the early part of the season 6 hens of the heavier breeds may be mated with a male bird, while later on the hens may be increased to 10; in the case of the lighter breeds the number of hens may be rather higher.

Time to Mate.—The best time to mate the birds in the breeding pens must be decided by the purpose for which the chickens are required. Where possible one pen should be mated up in the autumn for producing *table chickens*, the spring prices being the best of the year. For *egg production* the best period for hatching is approximately between 15th February and 15th April, the heavier breeds being hatched in the earlier and the lighter breeds in the later part of this period. The birds should have an opportunity to settle down and become accustomed to their surroundings before eggs are used for hatching.

Hints on the Hatching of Chickens.—*Selection of Eggs.*—Only eggs of uniform size and shape should be used for hatching. They should be clean, of good shape, and not more than four days old.

Preparation of Nest and Sitting Hen.—The nest should be placed, if possible, on the bare earth of the house, or, if there is danger from rats, on the floor of a shed with 3 in. of earth beneath the nesting material. This should be of clean, bruised straw. The nest should be slightly hollow, like a saucer, and the box should be clean.

The hen should be docile (White Orpingtons, Rhode Island Reds, Old English Game, and Silkies are amongst the best) and not under 18 months old. She should be tested for at least 18 hours before the clutch of eggs for hatching is given to her. Before being set she should be carefully examined for vermin, and well dusted with a reliable insect powder. The number of eggs set should be regulated by the size of the hen, and the season of the year. In the late autumn and early winter 9 eggs for a small hen, and 11 for a large hen will be sufficient, but, later on, these numbers may be increased to 11 and 13 respectively. If the eggs have been obtained from a distance they should be rested, the small end up, for quite 12 hours before being placed under the hen. They should be placed in the nest *in the evening*.

On the morning of the second day after the eggs are put into the nest and every day afterwards, at the same hour, the hen should be fed. Maize is the best food for this purpose.

For the first few days the hen must be watched, and, if necessary, put back upon the eggs after being fed and watered. She will usually go back of her own accord. A dust bath should always be provided; no hen will sit steadily if badly infested with external parasites. After the eggs begin to chip she should not be allowed to leave the nest until all the chickens are hatched. It is a mistake to take the chicks out of the nest as they hatch; they should be left to the care of the hen. They do not require food for 24-48 hours after they are hatched.

Care of the Incubator.—The incubator should be placed in a room or building where the temperature is fairly even, where there is suitable ventilation, and where the floor is not subject to undue vibration. The machine should stand quite level.

The first step is to light the lamp, and run the machine empty at an even temperature of 100° F. for 24 hours before filling it with eggs. All eggs put in should be as nearly as possible of the same age. Very fresh eggs will hatch probably on the 20th day, while very stale ones may take as long as 26 days. Those which have been laid not longer than three, or at the most, four days before being put into the drawer are best. The eggs should be placed in the drawer so that the small end is towards the middle. After putting in the eggs, the drawer should not be opened for 48 hours; and until considerable experience is acquired the maker's instructions for working the machine should be followed. Every morning and evening, until the eggs begin to chip, the drawer should be opened, and every egg turned over gently and exposed to the fresh air. The time of airing should vary from a minute or two on the third and fourth days, to five minutes at the end of a week, and fifteen minutes or so by the 17th day. When the eggs begin to chip, the drawer should not be opened more frequently than once in 24 hours. With the Hearson type of incubator, the dry chicks should be lifted out once in 24 hours and put into a drying box, the remaining eggs being carefully and very gently moved with the chipped side upwards. With the hot-air type, in which the nursery is below the hatching tray, chicks need not be taken out until all are hatched and dry.

The chicks may well remain in the incubator after hatching for 36-48 hours. The brooder, or fostermother, should be ready for them some hours before they hatch, and for the first three days, from October to April, the inner or sleeping chamber should be kept at a temperature of not less than 90° F.

Testing the Eggs.—The eggs should be tested in a dark room, with the help of a testing lamp, on the evenings of the sixth

and seventh days. With a large machine it is best to make two testings on consecutive evenings, or the drawer may be kept open too long and the eggs become unduly chilled. Each egg put back into the drawer as fertile should be specially marked. The staler eggs may need re-testing on the evening of the fourteenth day, but this should not be necessary if all the eggs be of the same, or nearly the same, degree of freshness when first put in.

As far as possible the room in which the machine is running should be kept at an even temperature, but free ventilation should be given at all times. Fresh air is a necessity if the chicks are to hatch out strong.

Chicks hatched in December, January, and February grow faster and attain a larger size than those hatched in earlier or later months, but if the weather be very severe they may need a little care for the first three weeks. After the first few days, however, the inner part of the brooder should not be kept too warm.

Chicks hatched in an incubator can be satisfactorily reared by a hen; but in this case care should be taken that (1) the hen is thoroughly broody, (2) all chicks put under one hen are given to her on the same evening, late, (3) the chicks are not chilled when carried out. The hen should be fed before the chicks are put under her, and may then be left without food or water for 36 hours. The hen should be fed upon maize for a few days, and the chicks upon food suitable for them.* Finely-broken flint grit should be given to chicks when a day old and every day afterwards.

If water is provided, newly-hatched chickens should always be offered food before they are allowed to drink. The water should be quite pure and fresh.

NOTES ON BEET OR MANGOLD FLY.

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For several years past sugar beet has been grown experimentally in this country, and during the last three seasons the industry has been placed on a commercial footing. In view of the new conditions entailed by the war and other factors it is likely that the area devoted to beet cultivation in England will increase. The establishment of a factory at Cantley, on

* See Leaflet No. 114 (*Feeding of Poultry*).

the river Yare, has provided a link between the growers and the consumers, and it is capable of dealing with a far larger amount of sugar beet than is at present raised for the purpose in this country.* In view of the importance of beet cultivation at the present time and its possible future in this country, it may not to be out of place to give a brief account of one of its principal insect enemies—the beet or mangold fly (*Pegomya hyoscyami* var. *betae*).

As early as 1737 the famous naturalist Reamur gave a description of the larva of an insect which he found mining the leaves of the henbane, and drew attention to its resemblance to the species attacking the leaves of the beet. At the present day we know that the two insects are almost certainly races of one and the same species. The flies attacking henbane, however, are paler coloured than those attacking beet. The former are known to entomologists as the species *Pegomya hyoscyami* Panz., while the race which attacks beet and mangold is regarded as the variety *Pegomya hyoscyami* var. *betae* Curt.

Distribution of the Beet Fly.—The beet fly is spread over the greater part of the British Isles and is widely distributed throughout Europe wherever beet, mangolds or spinach are extensively grown. The number of plants attacked by this insect is considerable, and includes, besides beet, mangold and spirach, such common weeds as henbane, deadly nightshade, orache, white goosefoot, nettle-leaved goosefoot. That the deadly nightshade serves as a food-plant of this insect has only recently been discovered by A. E. Cameron,† Board of Agriculture research scholar, working in the Department of Agricultural Entomology at Manchester University. In addition to studying the life-history of this species, Cameron has conducted some interesting experiments, which tend to show that the insect may be separated into distinct races exhibiting marked tendencies towards a particular food plant. Thus, he was unable to induce fertilised individuals reared upon deadly nightshade to deposit their eggs upon mangolds, and similarly *vice versa*. Furthermore, at Dartford, in Kent, where henbane and belladonna are grown on a large scale for the sake of their alkaloid bases, the former is heavily attacked by the insect while the latter plant remains unaffected. Further research requires to be prosecuted on this subject: it is desirable to ascertain, for instance, whether flies developed from larvae feeding on the wild henbane or on goosefoot will lay

* Orwin, C. S., and Orr, J., see this *Journal*, Vol. XXI., 1915, p. 969.

† *Annals of Applied Biology*, 1914, p. 43-76, 2 pls.

their eggs freely on mangold or beet. It has been definitely stated that certain of the thistles (*Carduus*), sow thistles (*Sonchus*) and dandelion (*Taraxacum*) harbour the insect, and that such weeds need to be kept clear from beet and mangold fields. It is further stated that the dock frequently harbours a leaf miner which appears to be *Pegomyia hyoscyami* var. *betæ*, and that it would be wise to wage war against this plant. There is no record, however, so far as the writer is aware, to prove that the mangold fly has ever been known to feed on any of these plants. The common leaf miners of the dock are *P. bicolor* and *P. nigrilaris*, species closely allied to the mangold fly, but not known to attack either beet or mangold. There is, therefore, at present no proof that beet or mangold crops are liable to be attacked by flies which have been bred from weeds in the neighbouring hedgerows. It is desirable to ascertain whether any good is likely to accrue, before advocating the eradication of certain of our commonest weeds from the vicinity of beet and mangold fields.

Enquiries made by the Board of Agriculture, and by certain of the agricultural colleges who have grown sugar beet on an experimental scale, have failed to bring to light any records in England of the crop being attacked by this insect. The attacks of the fly are intermittent; in some years it is very destructive, as, for instance, in Ireland during 1904; at other times its numbers, owing to unknown factors, are so reduced that the insect may become for the time being a negligible quantity. Nevertheless, it is likely that the sugar beet crop will sooner or later suffer from the depredations of this insect.

Life History.—As regards the life-history of the mangold fly, the female insect deposits her eggs on the underside of the leaf of the food-plant, generally in neat, parallel rows. On hatching, the maggots mine the leaf, devouring the soft parenchymatous tissue between the upper and lower epidermis. This method of attack gives the leaves a blistered appearance; attacked leaves rapidly flag and wither during dry weather, and serious damage to the crop frequently supervenes. There are at least three broods of the insect in the year, the average time for one brood of the insect to pass through its life-cycle being about 36 days. There is a good deal of overlapping of the various stages owing to differences in the times of emergence, so that the eggs, maggots, pupae and flies are all found to occur simultaneously from June to September. During the cold months hibernation takes place in the pupal stage at about two inches below the surface of the soil near the food plant.

Methods of Control.—The concealed feeding habits of the larvae or maggots of this insect make it difficult to apply insecticides effectually. Spraying the plant in the seedling stage, which is the most vulnerable period in the life of the plant, offers the best chance of success. Paraffin emulsion is the spray solution most generally recommended, but it cannot be uniformly relied on. Experiments carried out by Cameron* on a small scale, using this emulsion with the addition of nicotine, were found to be more effective. This insecticide appears to be efficacious against the younger larvae and also acts as a deterrent against the flies depositing their eggs.

Cultivation under favourable conditions, conducing to the healthy and rapid growth of the seedlings, strengthens the plants at their most vulnerable period. Stimulating chemical manures are also for this reason valuable. As undecayed manure attracts the insect, farmyard manure should be applied in the autumn in order to give it time to decay before the flies appear in the spring.

Little is known of the natural enemies of the mangold fly. Cameron† found, from observations carried out over two seasons, that the percentage of parasites to the total number of insects that emerged was 23.4 per cent. in 1912, and 28.2 per cent. in 1913. During the month of September, 1913, it reached 43 per cent. It is likely, therefore, that the natural enemies are an appreciable factor in reducing the numbers of this insect.

THE Turnip Gall Weevil (*Ceuthorhynchus pleurostigma*, Marsh. = *Ceuthorhynchus sulcicollis*, Gyll.) is at times a source of considerable loss to the turnip

The Turnip Gall Weevil. and cabbage crops, though, owing to the fact that the weevil injury somewhat resembles the more serious "finger-and-

toe" disease, the presence of the weevil is not always realised. In the case of finger-and-toe a fungus (*Plasmodiophora brassicae*‡) soil is responsible for the malformation of the root, while in the case of an attack by the weevil the growths are definite galls formed by the larvae of the beetle. Care should be taken to distinguish between the two diseases, as the methods of control are different. The general appearance of roots attacked by the gall weevil is shown by Figs. 4 and 5, and the characteristic features of the disease are dealt with in the section on "plants attacked and nature of injury."

* *Loc. cit.*, p. 67.

† *Loc. cit.*, p. 68.

‡ For further information on this disease see the Board's Leaflet No. 77.



FIG. 1.—
Turnip Gall Weevil ($\times 10$).



FIG. 2.—Larva ($\times 10$).



FIG. 3.—Pupa ($\times 10$).



FIG. 4.—Cabbage Root.



FIG. 5.—Turnip Root.

FIGS. 4 AND 5.—Appearance of Roots attacked by Turnip Gall Weevil.

Description of Insect.—The *adult insect* is a small beetle about $\frac{1}{8}$ in. in length with the long proboscis characteristic of the true weevils (*Rhynchophora*). In colour it appears to be black above and greyish on the underside, but if it be examined through a lens it will be seen that the upper surface is sparsely dotted with grey and white scales. The general appearance of the beetle is shown in Fig. 1. Several other species of the genus *Ceuthorrhynchus* are harmful to turnips, e.g., *C. assimilis*, the larva of which lives in the seed pods, *C. quadridens*, which in the larval state feeds in the stems of the flowering plants, and *C. contractus*, which as an adult attacks the seed leaves (*cotyledons*) of the young plant. The differences between these various species, and, in fact, between the genus *Ceuthorrhynchus* and other allied genera of the *Rhynchophora*, are minute, and from the growers' point of view not worth entering into, since each species may be known by the form of injury it produces.

The *larva* (Fig. 2), is a small shining white or yellowish maggot with a brown head. It is legless, and is found inside the galls, usually in a curled-up or semi-circular position.

The *pupa* is white, and has the general form shown in Fig. 3. It lies in the earth in a cell formed of particles of soil glued together by a sticky material secreted by the larva.

Life History.—The adult beetles emerge from the pupæ in spring and summer, and the females then lay their eggs in or on the roots of the food plants. On hatching, the young larva feeds on the root, which is stimulated in some way so that it forms a gall such as shown in Figs. 4 and 5. The gall at first is small, but grows gradually until it may attain the size of a small marble, and in many cases several galls coalesce to form a single large outgrowth in which may be found a number of chambers each tenanted by a larva.

When full fed the larvæ bite their way out of the galls and enter the earth, where they form the cells described previously, and there pupate.

The length of time spent in the various stages seems to vary within wide limits. The larval period is said to occupy a minimum of 4 weeks and a maximum of 14 weeks, and it is sometimes stated that the majority of the larvæ leave the galls in autumn, a few only remaining until March. In opposition to this view were some observations made in the early months of 1914 and 1915, when there were received numerous specimens in which most of the galls were still tenanted by larvæ, none of which pupated before the month of March. The probable

explanation that is the beetles emerge irregularly in spring and summer, and that the eggs from those appearing early produce a second brood of beetles in late summer, which in their turn may perhaps give rise to a third brood in September. These later broods will also infect the turnip crop, and larvæ of various ages may be found in the same crop at the same time. The insect, therefore, may spend the winter either as a larva or pupa, and this point is of some importance in considering the various means of control.

Plants Attacked and Nature of Injury.—The various forms of turnip, mustard, charlock, rape, cabbage, Brussels sprouts, savoy, and kohl-rabi are attacked, but complaints most often refer to the turnip and cabbage. In the case of root crops the damage lies in the great loss of crop, which is most marked when the plants are attacked at an early stage. If cabbage plants are badly attacked they are much stunted and make little "head."

The growths produced by the weevil may always be distinguished by the fact that they are hollow and frequently contain a larva. The galls are always more or less rounded, and there is never a production of the elongated finger-like growths formed in an attack by "finger-and-toe." Roots injured by the beetle show little tendency to rot, even after the larvæ have left the galls, while the fungus usually causes extensive decay.

Distribution.—The turnip gall weevil is widely distributed throughout the United Kingdom, and records of its attacks have been received from most English counties. It is also well known on the Continent, and is said to be destructive in France, Russia and Germany.

From the economic standpoint it may be regarded as an insect which is present everywhere, and one which, under certain conditions, may increase sufficiently to cause serious damage. It is likely to become prevalent wherever crops of the cabbage and mustard family are widely grown from year to year, or where weeds of this family (such as charlock) are allowed to spread unchecked. On the other hand, it is controlled, though to what extent is unknown, by weather conditions and by its natural enemies, among which birds must be included.

Methods of Control.—(1) Where the turnip crop is attacked the turnips should be consumed as soon as possible so as to destroy the larvæ before they leave the galls.

(2) If a cabbage crop is attacked the stumps and roots should be burned.

(3) After an attack the land should be deeply ploughed to bury or destroy the pupæ. In the case of a garden, trenching may be resorted to or a soil insecticide may be dug in.

(4) It is better to avoid growing turnips or cabbages on land adjacent to that which has been attacked the previous year, and in no case should affected land carry, in succession two crops liable to attack.

THE notes for the last two months have occasioned a considerable amount of correspondence. Enquiries on all subjects connected with foods and feeding are

Notes on Feeding welcome, and any information possessed
Stuffs in November: by the Institute will gladly be placed at
From the the disposal of correspondents. It will
Animal Nutrition facilitate early replies if correspondents
Institute, Cambridge will address their letters to Professor
University. T. B. Wood, School of Agriculture, Cam-

bridge. It may be added that Professor Wood would be very greatly obliged if readers of the *Journal* who have used any of the less known foods which have been suggested would be good enough to send a short account of their experience to the same address. These foods are being tried on the several farms over which the School of Agriculture has control, but it is desired to accumulate reliable knowledge of their properties, and this would be done much more quickly if readers would kindly adopt this suggestion.

This month's notes are on the same lines as before, except that in Table III, a new column has been included, column 5, giving the percentage of digestible carbohydrates and fibre in all the feeding stuffs. This has been done at the request of several readers of the *Journal* who wish to calculate the composition of the various rations suggested. Readers are reminded that the figures given are averages of the most reliable results of which records can be found, and that individual samples may differ considerably from the average figures given.

The following instance shows the kind of variation from the average figures which commonly occurs. Since last month three samples of ground-nut cake have been analysed, with the following results:—

				Sample 1.	Sample 2.	Sample 3.
Water	..	..	..	9.8	7.7	9.6
Protein	..	..	..	47.7	45.1	47.7
Oil	..	..	..	6.1	9.8	9.5
Carbohydrates	..	..	..	24.7	20.4	24.0
Fibre..	..	..	..	6.5	11.5	4.7
Ash	..	..	..	5.0	5.5	4.5
				100.0	100.0	100.0

From these analyses the percentages of digestible nutrients and the number of food units per ton have been calculated, as follows :—

				Sample 1.	Sample 2.	Sample 3.
Digestible protein	..	..	..	42.9	40.5	42.9
Digestible fat	..	..	..	5.5	8.8	8.5
Digestible carbohydrates						
and fibre				21.6	18.1	20.6
Food units per ton	..	..	..	142.6	141.3	149.1

A sample of cake made from a mixture of soya bean and cottonseed, which is being largely sold under the name of Soycon, has also been analysed. It was found to contain 88 food units per ton. At £9 per ton this works out at a trifle over 2s. per food unit, which is just about the price of English linseed cake this month.

Comparison of Table II, with the similar table in last month's notes shows that all feeding stuffs have advanced in price. The average increase is 2d. per food unit, which corresponds to about 10s. to 20s. per ton, according to the number of food units in a ton. Individual increases vary from $\frac{1}{4}$ d. to as much as 4d. per unit. Ground-nut cake, palm-nut kernel cake, coconut cake, linseed cake, undecorticated cotton cake, oats and Chinese beans have risen in price only 1d. or less per unit. Malt culms, Burmese rice meal, bran, middlings, maize meal, linseed, linseed oil and peas (English dun and Calcutta white) have advanced 3d. or more per unit. Ground-nut cake is still the cheapest concentrated food on the market, and appears to be giving excellent results when judiciously used for fattening bullocks and sheep, and for milch cows. Once more readers may be reminded that ground-nut cake contains so much protein that unless the root ration is very heavy it should be mixed with a starchy food of some kind, such as maize, rice meal, dried grains or one of the wheat offals, whichever is most suitable for the purpose in view. The Institute is indebted to a correspondent who pointed out an arithmetical error in last month's notes in computing the proportions in which ground-

TABLE I.

Feeding Stuff.	Reduced from digestible nutrients.				Approximate prices per ton, at the end of November.				Approximate prices per Food Unit.											
	Food Units.				Liverpool.		Hull.		Bristol.		London.		Liverpool.		Hull.		Bristol.			
	Nutritive Ratio.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	
Soya bean cake	1:1:12	125 3	11	5	0	12	5	0	12	5	0	12	5	0	12	5	0	12	5	0
Indian linseed cake	1:1:12	126 3	11	5	0	12	5	0	12	5	0	12	5	0	12	5	0	12	5	0
English linseed cake	1:1:10	123 1	11	5	0	12	5	0	12	5	0	12	5	0	12	5	0	12	5	0
Bombay cotton cake	1:1:35	7 6	0	0	9	0	0	9	0	0	9	0	0	9	0	0	9	0	0	
Coconut cake	1:1:38	102 6	9	0	0	9	0	0	9	0	0	9	0	0	9	0	0	9	0	0
Palm-nut kernel cake	1:1:40	83 5	7	10	0	7	10	0	7	10	0	7	10	0	7	10	0	7	10	0
Groundnut cake	1:1:36	43 5	11	10	0	11	10	0	11	10	0	11	10	0	11	10	0	11	10	0
Chinese Leans	1:1:36	101 2	10	5	4	10	5	4	10	5	4	10	5	4	10	5	4	10	5	4
English mangle peas	1:1:31	97 2	15	2	3	15	2	3	15	2	3	15	2	3	15	2	3	15	2	3
English dun peas..	1:1:31	97 2	15	2	3	15	2	3	15	2	3	15	2	3	15	2	3	15	2	3
English white peas	1:1:31	95 8	15	2	3	15	2	3	15	2	3	15	2	3	15	2	3	15	2	3
Argentine maize..	1:1:15	95 8	10	5	4	10	5	4	10	5	4	10	5	4	10	5	4	10	5	4
Argentine maize..	1:1:13	94 2	9	2	0	9	2	0	9	2	0	9	2	0	9	2	0	9	2	0
Maize meal	1:1:3	86 5	8	19	3	8	19	3	8	19	3	8	19	3	8	19	3	8	19	3
Maize gluten meal	1:1:3	86 5	9	17	6	9	17	6	9	17	6	9	17	6	9	17	6	9	17	6
English feeding barley	1:1:80	83 0	9	10	0	9	10	0	9	10	0	9	10	0	9	10	0	9	10	0
English oats	1:1:80	72 4	10	10	0	10	10	0	10	10	0	10	10	0	10	10	0	10	10	0
Maize meal	1:1:30	69 9	7	0	0	7	0	0	7	0	0	7	0	0	7	0	0	7	0	0
Maize meal	1:1:35	78 5	7	10	0	7	10	0	7	10	0	7	10	0	7	10	0	7	10	0
Provers' grains (dried)	1:1:35	78 5	8	12	6	8	12	6	8	12	6	8	12	6	8	12	6	8	12	6
Provers' grains (dried)	1:1:35	78 5	8	12	6	8	12	6	8	12	6	8	12	6	8	12	6	8	12	6
Wheat meal	1:1:30	80 3	8	15	0	8	15	0	8	15	0	8	15	0	8	15	0	8	15	0
Wheat middlings	1:1:33	80 3	8	15	0	8	15	0	8	15	0	8	15	0	8	15	0	8	15	0
Wheat shorts	1:1:30	80 3	8	15	0	8	15	0	8	15	0	8	15	0	8	15	0	8	15	0
Wheat shorts	1:1:30	80 3	8	15	0	8	15	0	8	15	0	8	15	0	8	15	0	8	15	0
Wheat bran	1:1:47	77 5	8	10	0	8	10	0	8	10	0	8	10	0	8	10	0	8	10	0
Wheat bran (thrust)	1:1:47	77 5	8	10	0	8	10	0	8	10	0	8	10	0	8	10	0	8	10	0
Feeding treacle	1:1:9	157 6	13	6	0	13	6	0	13	6	0	13	6	0	13	6	0	13	6	0
Feeding treacle	1:1:9	157 6	13	6	0	13	6	0	13	6	0	13	6	0	13	6	0	13	6	0
Lined oil	1:1:9	230 0	33	15	0	33	15	0	33	15	0	33	15	0	33	15	0	33	15	0

^a 2nd grade 59 28. 54.

nut cake and dried grains should be mixed in order to yield a mixture having a nutritive ratio of 1 : 2, or about the same as a mixture of linseed and cotton cakes. The equivalent mixture should have been given as 2 lb. of ground-nut cake and 3 lb. of dried grains, which will have a nutritive ratio of about 1 : $1\frac{3}{4}$, and will contain about $6\frac{1}{2}$ per cent. of fat.

Suggested Rations for December.—No considerable change in the conditions of feeding has occurred since last month's notes appeared, except the general rise in the price of feeding stuffs. It does not, therefore, appear necessary to make more than a few detailed alterations in rations.

For Horses on Farm Work.—It does not seem possible to economise on last month's rations. The price of most of the

TABLE II.
Average Prices per Food Unit.

	s. d.		s. d.
Brewers' grains (wet) ..	1 2 $\frac{1}{2}$	Wheat bran (broad) ..	2 1 $\frac{1}{2}$
Ground-nut cake ..	1 3 $\frac{1}{2}$	Maize, American ..	2 2 $\frac{1}{2}$
Maize gluten feed ..	1 7	Wheat sharps ..	2 2 $\frac{1}{2}$
Soya-bean cake ..	1 7 $\frac{1}{2}$	Beans, English ..	2 3
Coconut cake ..	1 9	Maize meal ..	2 3
Decorticated cotton cake	1 9 $\frac{1}{2}$	Rice meal, Egyptian ..	2 3
Brewers' grains (dried) ..	1 9 $\frac{1}{2}$	Linseed ..	2 4 $\frac{1}{2}$
Palm-nut kernel cake ..	1 9 $\frac{1}{2}$	Cotton cake, Egyptian	2 6 $\frac{1}{2}$
Maize, Argentine ..	1 10 $\frac{1}{2}$	„ „ Bombay ..	2 8 $\frac{1}{2}$
Linseed cake, Indian ..	1 11	Linseed oil ..	2 10
Maize germ meal ..	1 11 $\frac{1}{2}$	Peas, English dun ..	2 11
Wheat pollards ..	2 0	Oats, Argentine ..	2 11 $\frac{1}{2}$
„ middlings ..	2 0 $\frac{1}{2}$	„ English ..	2 11 $\frac{1}{2}$
Linseed cake, English ..	2 0 $\frac{1}{2}$	Barley, English feeding	2 11 $\frac{1}{2}$
Malt culms ..	2 0 $\frac{1}{2}$	Feeding treacle ..	3 0
Wheat bran ..	2 0 $\frac{1}{2}$	Peas, English maple ..	3 0 $\frac{1}{2}$
Rice meal, Burmese ..	2 1	„ Calcutta white ..	3 2
Beans, Chinese ..	2 1 $\frac{1}{2}$		

ingredients has gone up considerably, but with the present scarcity of horses and labour it is scarcely justifiable to recommend cheaper mixtures containing foods which have not been tried by the Institute.

For Breeding Mares and Foals.—See notes for October and November.

For Milch Cows.—It has been pointed out to the Institute, and it is certainly the case, that the rations suggested last month are considerably below the feeding standards commonly accepted for milch cows. There seems no reason, however, to alter the suggestions. The rations suggested are the most economical rations the Institute dare recommend in war time,

and are based on experience with the herd of milking shorthorns on the University farm. On these rations full-grown cows have been found to milk steadily through the winter without losing an undue amount of live-weight and to finish the winter in fair store condition.

The feeding standards referred to are based on experiments made by German investigators with continental fodders on

TABLE III.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Name of Feeding Stuff.	Nutritive Ratio.	Per cent. digestible.			Starch equiv. per 100 lb.	Linsseed Cake equiv. per 100 lb.
		Protein.	Fat.	Carbo-hydrates and Fibre.		
<i>Foods Rich in both Protein and Oil or Fat.</i>						
Ground-nut cake ..	1: 0'8	45'2	6'3	21'1	77'5	102
Soya-bean cake ..	1: 1'1	34'0	6'5	21'0	66'7	88
Decort. cotton cake ..	1: 1'2	34'0	8'5	20'0	71'0	93
Linseed cake, Indian ..	1: 1'9	27'8	9'3	30'1	77'1	101
Linseed cake, English ..	1: 2'0	26'7	9'3	30'1	76'0	100
Cotton cake, Egyptian ..	1: 2'1	15'5	5'3	20'0	40'0	53
Cotton cake, Bombay ..	1: 2'5	13'1	4'4	21'5	37'6	49
Maize gluten feed ..	1: 3'0	20'4	8'8	48'4	87'4	115
Brewers' grains, dried ..	1: 3'5	14'1	6'6	32'7	50'3	66
Coco-nut cake ..	1: 3'8	15'3	8'2	41'4	76'5	101
Palin-nut kernel cake ..	1: 4'0	12'5	7'7	32'0	63'0	83
Linseed ..	1: 5'9	18'1	34'7	20'1	119'2	157
<i>Fairly Rich in Protein, Rich in Oil.</i>						
Maize germ meal ..	1: 8'5	9'0	6'2	61'2	81'0	107
Rice meal ..	1: 9'4	6'8	10'2	38'2	68'4	90
<i>Rich in Protein, Poor in Oil.</i>						
Peas, Calcutta, white ..	1: 2'1	23'3	1'1	45'9	66'9	88
Beans, English ..	1: 2'6	19'3	1'2	48'2	67'0	88
Beans, Chinese ..	1: 2'6	19'6	1'7	47'9	67'0	88
Peas, English maple ..	1: 3'1	17'0	1'0	50'0	70'0	92
Brewers' grains, wet ..	1: 3'5	3'5	1'5	8'6	12'7	17
Malt culms ..	1: 5'6	11'4	1'1	38'6	38'7	51
<i>Cereals, Rich in Starch, not Rich in Protein or Oil.</i>						
Barley, feeding ..	1: 8'0	8'0	2'1	57'3	67'9	89
Oats, English ..	1: 8'0	7'2	4'0	47'4	59'7	79
Oats, Argentine ..	1: 8'0	7'2	4'0	47'4	59'7	79
Maize, American ..	1: 11'5	6'7	4'5	65'8	81'0	107
Maize, Argentine ..	1: 11'3	6'8	4'5	65'8	83'5	110
Maize meal ..	1: 13'0	5'5	3'5	63'9	77'5	102
Wheat middlings ..	1: 5'3	12'0	3'0	56'0	59'1	78
Wheat sharps ..	1: 5'0	12'0	4'0	50'0	58'4	77
Wheat pollards ..	1: 5'3	11'6	3'5	53'0	54'1	71
Wheat bran ..	1: 4'7	11'3	3'0	45'0	49'7	65
Wheat bran, broad ..	1: 4'7	11'3	3'0	45'4	48'1	63

continental breeds of cows. They are supposed to give the amount of food which will enable a cow of known weight to yield a certain weight of milk without losing weight. It is recognised that with the ration suggested the cows will lose in live-weight, but only as much as will bring them back to fair store-breeding condition in the spring. The cows on the University farm are closely watched during the winter so that

the ration of each cow may be raised or lowered to meet individual requirements. If a cow shows signs of laying on flesh her ration is lowered. If she looks poor it is raised. This practice may be commended to all who wish to get the best out of their stock in these times of dear feeding stuffs.

For growing heifers or for cows intended to be ready for the butcher as soon as they are dry a heavier ration per 1,000 lb. live-weight should be used. It may also be advisable to give heavier rations to other breeds less liable to lay on flesh than shorthorns, as, for instance, Dutch or Holsteins and Guernseys. The suggested rations are for cows weighing about 10 cwt. live-weight. Larger cows will require, of course, larger basal rations of roots, hay, straw and concentrated food. The whole ration should be increased by about one-tenth for each increase of 1 cwt. in live-weight.

Bullocks, Calves, Sheep and Pigs.—For fattening bullocks, stores intended for grass beef next summer, stores in the yards, calves, fattening sheep, ewes heavy in lamb, and for fattening pigs, see last month's notes.

For the information of anyone who wishes to feed higher are given rations based on the usually accepted feeding standards. The basal ration is the same as that given last month, namely, 56 lb. roots, 8 lb. hay, 12 lb. straw, and 5 lb. of concentrated food made up of 3 lb. bran, 1 lb. linseed cake, and 1 lb. decorticated cotton cake. It is in the additional food for each extra gallon of milk that the feeding standards differ from the recommendations made—*i.e.*, these notes recommended about 2 lb. of concentrated food as above for each extra gallon above 2 gal. per day. According to the accepted standard the amount of concentrated food per extra gallon of milk should be about $3\frac{1}{2}$ to 4 lb.

EVERY farm in Herefordshire has at one time or another possessed its orchard of cider, perry, dessert and cooking fruit. All the old orchards are in grass; the trees are all on the old free stocks and are of the standard form so as to admit of cattle and sheep grazing below them.

**The Farm Orchards
of Herefordshire.**

A fairly wide range of varieties of *apples* are grown, whether for cider, dessert or cooking purposes. Some of the more modern varieties are being introduced into the old orchards, but in many cases they suffer from the domination of the old trees to such an extent that they are either unable to make rapid

headway or are completely suppressed. There are great possibilities for apple culture in the county, the effect of the soil (over the Old Red Sandstone) being to produce a colour and finish on the apples which cannot be attained in the other large apple-growing districts.

Pears, for perry making, are found in great variety, and, although very old, are remarkably healthy and vigorous. Some of the small pears are of good flavour and, if worked on the quince, might improve in size.

In these old orchards, *plums* are found to a less extent than apples and pears. *Cherries* are grown in some districts, especially in the vicinity of Bromyard, but the trees do not give the impression of being so healthy and vigorous as in well-managed Kent orchards, and they are usually grown at a greater elevation in Herefordshire.

Pollination troubles are scarce, both cooking and dessert varieties seem to bear well and regularly, and varieties of apples like Annie Elizabeth, Lane's Prince Albert and Cox's Orange Pippin, which are often faulty croppers, seem to benefit by the pollen of the cider varieties which are usually equally distributed throughout the orchards. In the same way the cropping of the more modern dessert and cooking varieties of pears is assisted by the interplanted perry varieties.

At several centres in the county there are commercial growers with large plantations of bush apple and pear trees on the paradise and quince stocks, and also on the crab and free stocks.

Need for Proper Treatment.—Generally speaking, the old farm orchards have, until recently, been very much neglected, and the need for proper manuring and drastic pruning and spraying is urgent.

The Education Committee of the Hereford County Council are at present conducting a competition with a view to the improvement of these orchards, the condition of the herbage as regards freedom from weeds, and value for grazing purposes being taken into account in judging improvement. The competition is so arranged that awards are made on the actual improvement effected, thus offering the greatest inducement to the owners of the worst orchards. Very considerable improvements are already discernible in the size of fruit, although where trees are old it will be some time before any great change is apparent. If a sufficient number of farmers

enter the present competition, and the scheme is carried through, the general standard of cultivation cannot fail to be improved.

Marketing.—A further direction in which great improvement is possible is in picking, grading, packing and marketing; the great bulk of the farm orchard fruit is carted to market in a very rough fashion after being roughly removed from the trees. After the general standard of cultivation has been raised the next step should be to teach farmers to pick, grade, pack and market their cooking and dessert fruit to the best advantage.

Further, much of the cider and perry fruit is allowed to go to waste in outlying districts, surplus fruit either being left to rot or being fed to pigs. Only the large growers attempt to sell their fruit to cider makers, and prices in recent years have, unfortunately, not been very remunerative.

THE Board have issued a revised edition of their Special Leaflet No. 32 (*War Food Societies*), copies of which can be obtained, free of charge, on application

War Food Societies. to the Board. The leaflet includes the following notes:—

Since the outbreak of war the Board have issued a number of leaflets with the object of affording some guidance to allotment holders, gardeners, and others who desire to increase their supplies of home-grown food, but printed information will not enable an inexperienced person to make the most of his opportunities. Many who would gladly add to their supplies of food, do not know how to set about getting possession of a plot of ground, or how to buy suitable manures, or how to select the best varieties of potatoes, cabbages, etc., for the purpose they have in view. To assist such people the Board think that local societies might be very useful.

The objects of such societies should be to secure an increased production of food, both by improving the methods adopted in existing gardens and allotments and by obtaining additional land for the use of those who are willing to cultivate it.

Most country villages are well supplied with gardens and allotments, but their management often leaves much to be desired, and they should be capable of producing much more food under skilled guidance and advice. In urban and suburban areas the allotments are usually well managed, but,

as a rule, there are too few of them, and War Food Societies might do most valuable work in such areas by obtaining the use of additional land for cultivation. Excellent work has been done in this direction by the Home Food Culture Society, Victoria Viaduct, Carlisle, which has obtained from land-owners in Cumberland and Westmorland a number of plots of land, free of rent, rates and taxes, for use as allotments. The Society provides technical advice and organises a supply of seedling plants. Similar work is being done in London by the Vacant Land Cultivation Society and by the Church Army.

How to Start a Society.—The initiative in forming a society may be taken by any local resident, but it is desirable to secure in all cases the co-operation of members of the town, urban district or parish council, which is the authority responsible for the provision of allotments. The chairman of the local authority might be invited to call a meeting of local residents, allotment holders, etc., to consider whether a society should be formed and, if so, to appoint a small committee. Where there is already a gardening or allotment society in existence it might be used as a nucleus. The Agricultural Organisation Society, Queen Anne's Chambers, Tothill Street, Westminster, London, S.W., will be glad to advise or assist in the formation of societies. The registration of societies under the Industrial and Provident Societies Act or the Friendly Societies Act is not essential.

Methods of Work.—The methods to be adopted will vary with the local conditions. If it appears that there is a demand for additional allotments which is likely to be permanent, the society should urge the town, urban district or parish council to use its statutory powers to acquire land for the purpose. Where the demand is for the temporary use of land for cultivation during the war, the society should ascertain what vacant or uncultivated land is available in the district, and approach the owners or agents for permission to cultivate it. In order to meet objections on the ground of the liability for the payment of compensation, it may be desirable to avoid the creation of a tenancy and to ask only for a licence to enter and cultivate the plots for specified purposes. In rural parishes there is usually a sufficiency of land, and in such places the society should mainly direct its attention to securing increased production and preventing waste.

Supply of Seeds, Manures, Plants, etc.—The society should endeavour to organise the supply of seeds, manures, plants, tools, feeding stuffs, &c., for the use of its members, and it

might arrange to purchase these in bulk from a local agricultural or industrial co-operative society. In many cases landowners may be willing to supply, free of charge, a number of seedling plants from their own gardens.

Disposal of Produce.—The society should endeavour to see that, as far as possible, the gardens or allotments are used for the production of food for home consumption. It is most desirable in these times that each household should produce as much food as possible for itself, and so save money and also reduce the consumption of food which has to be imported from abroad. If there is any surplus produce, the society should try to organise its collection and sale to a local agricultural or industrial co-operative society or to the local tradesmen. It is desirable to enquire from any possible purchasers the class of produce which is most needed in order to advise what should be grown.

Advice.—Societies should make a point of obtaining expert advice in their work. Reference should be made to Special Leaflet No. 25 (*Technical Advice for Farmers*), which contains particulars of the system which has been set up for providing expert advice on all agricultural questions, and gives the names and addresses of the persons from whom advice can be obtained in each county. In addition, special war agricultural committees have been established by the county councils in most counties and districts, and their assistance should be sought in cases of difficulty. In most rural villages the landowners and principal residents will be ready to lend the services of their gardeners for instruction and advice, and in many cases also the village schoolmaster is competent to give a great deal of help.

Suggestions for Work.—Some suggestions for the work of War Food Societies are also given in the leaflet. The subjects touched upon are the growing of vegetables, goat-keeping, pigs, poultry, preservation of eggs, rabbit-breeding, pigeon-breeding, bees, preservation of fruit, collection of acorns, etc., rough hay and litter, and bracken. Readers may obtain from the Board leaflets on most of these subjects, as indicated in the leaflet referred to.

The suggestions do not, of course, apply equally to all the societies that might be formed. Urban or suburban societies would usually concern themselves with gardening, or with gardening and poultry-keeping, while in the country pigs could be kept, and food and litter collected to supplement what was grown.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

SOILS AND MANURES.

The Valuation of Basic Slag (*Devon County Agric. Com., Rept. on Field Expts., 1912-14*).—The value of the phosphate in basic slag which is soluble in citric acid was compared with that which is insoluble, both in pot and field experiments.

In the pot experiments with oats, although the best crop was obtained from the slag containing the highest proportion of citric soluble phosphate, the yields from slags containing lower percentages were not proportional to these percentages; it was clear that the oat plant could readily utilise the phosphate which was insoluble in citric acid. It was also shown that the insoluble phosphate in basic slag is active enough to feed such a short-lived plant as mustard, and that the phosphate soluble in citric acid is not of any more value than the insoluble phosphate for this crop.

In the field experiments with turnips the following average results were obtained:—

CENTRE 1.		CENTRE 2.	
Solubility of Slag. Per cent.	Weight of Crop. Tons. cwt.	Solubility of Slag. Per cent.	Weight of Crop. Tons. cwt.
19·4	22 17	19·5	8 11
13·8	21 19	7·74	6 4
33·3	23 16	33·59	11 15
17·3	21 10	13·24	11 17

It is concluded that the extraction of basic slag with a 2 per cent. solution of citric acid does not give a true value of the utility of the basic slag, the insoluble phosphate having considerable value.

1. **Reclamation of Bog Land.**—In their *Journal* for July, 1915, the Department of Agriculture and Technical Instruction for Ireland publish an account of some experiments which are at present in progress in Ireland on the reclamation of bog land.

As the manurial treatment of Irish bogs appears to differ from that of Continental bogs, a series of pot experiments was undertaken with samples of peat obtained from different localities, some from the surface, others from the cut away portion of the bog. With a few exceptions lime was found to be the controlling factor; in fact it was in most cases found impossible to grow cruciferous crops such as rape without lime, while cereals generally died out after a brief existence. In the majority of cases the effect of the absence of phosphate was more marked than that of nitrogen, while potash was invariably the least important of the four manurial ingredients.

In 1914 a small scale experiment was laid down in the Bog of Allen The bog (known locally as "red bog") was dug over during the previous winter and left to weather, with the intention of growing a crop of potatoes in 1915. The analysis was as follows (per cent.):—Water 16·87, organic matter 79·21, calcium oxide ·19, nitrogen ·31, potash

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

0.26, and a trace of phosphoric acid. Rape, rye, and potatoes were sown on 20th June.

The young rootlets of the *rape*, on the untreated plot, and those on the plot that received no lime, appeared as if burnt up as soon as the seeds germinated, with the result that not a single plant lived. Very little growth was made where nitrogen or phosphate was omitted from the dressing, and, while the want of potash was not nearly so marked, its omission from the complete dressing with lime considerably decreased the yield.

The *rye* germinated on the untreated plot, but was a complete failure afterwards. No grain was produced where no lime was given, and the result was but little better where no phosphate was given. A fair growth was made without nitrogen or without potash, but the grain here was merely "tailings." A fairly good crop both as regards grain and straw was obtained from the complete dressing (including lime).

The *potato* trial indicated that this crop is not so dependent on lime as rape or rye, and that a deficiency of phosphate is as great a drawback as a deficiency of lime. The following figures show the approximate yield per acre :—

	Tons. cwtl.	
Untreated	1	0
Nitrogen, phosphate, and potash..	1	17
Nitrogen, potash, and lime ..	1	14
Phosphate, potash, and lime ..	2	15½
Nitrogen, phosphate, and lime ..	3	0
Nitrogen, phosphate, potash, and lime ..	5	0

When the short time the peat had to weather after it was dug over, and the lateness of the season when the crops were sown, are taken into account the results may be considered fairly satisfactory for a first crop.

It would appear that fair crops can be grown on some classes of unreclaimed bog land with artificial manure and lime without the use of farmyard manure, provided the mechanical conditions as regards moisture are favourable.

FIELD CROPS.

Varieties of Wheat (*Woburn Field Expts.*, 1914; *Jour. Roy. Agric. Soc.*, 1914; *J. A. Voelcker, D.Sc.*).—Squarehead's Master gave much better returns in corn and straw than Svalöf and Tystofte. The first-named produced 4 bush. per acre more corn than Tystofte and 12 bush. more corn than Svalöf; it gave the heaviest weight per bush. and was valued highest.

Varieties of Barley (*Woburn Field Expts.*, 1914; *Jour. Roy. Agric. Soc.*, 1914; *J. A. Voelcker, D.Sc.*).—The yields of grain, in bush. per acre, were :—Tystofte Prentice 45.8, Archer 44.8, Svalöf Primus 42.9. Tystofte Prentice also gave the highest priced grain, while Svalöf was much the earliest variety.

Varieties of Spring Wheat (*Univ. of Leeds and Yorks. Co. for Agric. Educ.*, Rept. No. 97; *J. Polls, B.Sc., N.D.D.*).—On a medium loam spring wheat followed swedes (carted off) after barley. Seed was drilled at the rate of 4 bush. per acre on 26th March, a dressing of ½ cwt. sulphate of ammonia, 1 cwt. superphosphate, and 1 cwt. steamed bone flour being previously applied. Red Fife was cut on 31st August,

and Red Marvel and Dreadnought on 9th September. Spring-sown Victor was also tried, but appeared to be a variety requiring a longer period for maturing than can in an ordinary season be secured by sowing as late as the end of March. The yields were as follows, per acre : Dreadnought 36½ bush. grain, 32 cwt. straw ; Red Marvel 35½ bush. grain, 30½ cwt. straw ; Red Fife (Irish seed) 25 bush. grain, 29 cwt. straw.

A monetary valuation of grain and straw was obtained with the following results per acre : Red Marvel, £11 6s. 5d. ; Dreadnought, £11 3s. 6d. ; Red Fife, £8 15s. 1d. Dreadnought was a little later than Red Marvel in maturing, and would doubtless have yielded a better sample of grain had it been sown earlier in the spring. Red Fife gave a splendid sample of grain, but owing to its disappointing yield its cultivation is not recommended in Yorkshire.

FEEDING STUFFS AND DAIRYING.

Significance of the Act of Milking (*Paper read at the British Association Meeting, 1915; C. Crowther, M.A., Ph.D.*).—Data were adduced in support of the view that, in addition to removing milk previously formed, the handling of the teats may impart a stimulus to further vigorous secretion during the period of milking.

The milk from the "quarter" of the udder milked first had a tendency to steadily increasing fat content as the quarter was emptied, a tendency which was much less pronounced with the subsequent "quarters" milked, although in the case of all four quarters there was a rapid rise in the percentage of fat towards the close of milking. When the quarters were milked in pairs the results from the first pair resembled those from the first quarter, and those from the second pair those from the last quarter ; when the four quarters were milked simultaneously the results from each resembled those from a "first quarter." The milk from the quarter milked first was almost invariably the richest in fat, and that from the last quarter the poorest.

The foregoing observations led to the conclusion that the time-factor must be of considerable importance in milking. This was confirmed by a comparison of very quick and very slow milking by ordinary methods, which showed a difference of 10 per cent. of milk-yield and 40 per cent. of fat-yield in favour of the quick milking.

A further comparison was made of ordinary milking, taking the teats in pairs, and simultaneous milking, by two milkers, of all four quarters. A difference of 2 per cent. in milk-yield and 6 per cent. in fat-yield in favour of the latter method was indicated, despite the occasional disturbance of the cow inevitable with this mode of milking. Further tests with the milking-machine are proposed.

The Importance of the Fibre Content of Concentrated Foods (*Paper read at the Agric. Educ. Assoc. Meeting, 1915, by J. Porter, B.Sc.; summarised from "Farmer and Stockbreeder," 20th and 27th September, 1915*). This paper emphasises the *mechanical* as distinguished from the *chemical* effect that concentrated foods are likely to have on the bulky part of the ration. Cereal straws and concentrated foods which are rich in fibre require a large amount of energy for mastication and digestion, thus reducing the surplus nutrients (after maintenance) available for the production of meat and milk. A further point is that, to get the best results from feeding, the food must pass through the animal's body

neither too quickly nor too slowly; the fibre has a binding, the oil a laxative, effect. Dry and fodder crops are binding, while succulent and immature fodder crops have a laxative tendency, turnips being generally more laxative than swedes. When the bulky part of the ration is laxative, concentrates rich in fibre could be used as correctives, especially when poor in oil, and *vice versa*.

Provided the concentrated part of the ration contains sufficient albuminoids, is palatable and sufficiently laxative, it does not seem to matter from what source the concentrated part of the ration is derived.

The results of various experiments with cows, fattening cattle, sheep and pigs are quoted in support of the above contentions.

The following feeding standards are given by Mr. Porter for the concentrated part of the ration: For *dairy cows* receiving hay or straw and roots—albuminoids 15 to 20 per cent., oil 4 to 6 per cent., fibre (not exceeding) 10 per cent. For *fattening cattle* and *sheep*, where fodder crops and roots are being supplied in fairly liberal quantities: early stages of fattening—albuminoids 15 to 20 per cent., oil 4 to 6 per cent., fibre (not exceeding) 15 per cent.; later stages of fattening—albuminoids 20 to 25 per cent., oil 6 to 8 per cent., fibre (not exceeding) 10 per cent. For *pigs* the best standard for a pig meal is: albuminoids 10 to 15 per cent., oil 2 to 4 per cent., fibre (not exceeding) 6 per cent.

Composition and Digestibility of Various Kinds of Straw (*Landw. Versuchs-Stat.*, Bd. 84, 1914).—To eliminate soil and manurial conditions the different kinds of straw examined were taken from the same farm; but to test the effect of weather, the samples were selected both in the dry year of 1911 and the wet year of 1912. The results were as follows:—

Straw.	Crude Pro- tein.	Pure Pro- tein.	Carbo- hydrates	Crude Fat.	Crude Fibre.	Pento- sans.	Ash.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
1911 (dry year).							
Oat	3.35	3.25	45.36	1.73	42.84	26.21	6.72
Winter barley ..	5.02	4.65	45.95	1.54	42.06	25.93	5.43
Spring barley ..	4.00	3.80	45.34	1.40	44.29	26.10	4.97
Winter wheat ..	2.63	2.46	47.02	1.12	46.26	25.68	2.97
Spring wheat ..	2.74	2.61	44.47	1.85	46.61	27.41	4.33
Winter rye ..	3.36	3.21	42.73	1.78	48.59	26.65	3.54
Spring rye ..	3.68	3.44	48.51	1.83	42.99	26.07	2.99
1912 (wet year).							
Oat	2.96	2.66	41.67	1.62	49.03	26.41	4.72
Winter barley ..	5.49	5.29	43.00	0.89	44.55	26.70	6.07
Spring barley ..	3.56	3.39	42.01	1.39	45.79	27.03	7.25
Winter wheat ..	4.78	4.58	42.06	0.88	47.86	25.11	4.42
Winter rye ..	3.80	3.50	45.34	1.62	45.75	26.48	4.49
Spelt	2.74	2.52	42.09	0.93	46.93	27.59	7.31

The small differences, if any, compared with early analyses of straw, revealed by the above table are taken to show that the effect of modern plant breeding in producing stronger strawed varieties has had hardly any effect on the composition of the straws. Further, although it has been asserted that the straw of winter varieties contains more fibre than that of spring varieties of cereals, this is not borne out by the results of the analyses.

Experiments were carried out with wethers and the following digestible constituents found :—

Straw.	Pro- tein.	Carbo- hydrates	Crude Fat.	Crude Fibre.	Dig. Albu- minoids.	Starch Value.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Oat, 1911	0.36	21.68	0.74	22.96	0.26	21.44
" 1912	0.16	15.63	0.71	29.71	—	18.26
Spring rye, 1911 ..	1.17	23.24	0.95	23.43	0.97	24.43
Winter rye, 1911 ..	0.76	17.43	1.11	26.68	0.61	17.97
" 1912	1.03	16.01	0.83	25.91	0.73	16.82
Spring wheat, 1911..	0.15	18.14	0.08	23.35	0.02	15.61
Winter wheat, 1911..	—	18.34	0.48	21.19	—	13.38
" 1912	2.49	15.05	0.50	22.40	2.29	13.15
Spring barley, 1911..	0.62	20.40	0.62	24.23	0.42	19.61
" 1912	0.83	16.38	0.54	25.51	0.66	16.71
Winter barley, 1911..	0.47	22.24	0.95	24.98	0.10	24.26
" 1912	2.62	17.80	0.50	22.05	2.42	16.99
Spelt, 1912	1.15	13.64	0.59	21.92	0.93	10.04

These figures show, on the average, a starch value of 19.34 for the straw of spring cereals and of 16.10 for that of winter cereals, and on this basis the former would have the higher feeding value, in spite of the fact that there are no real differences between the crude fibre contents of the two sorts.

The influence of the weather on the composition appears to be relatively small, or, at least, not so great as with the protein rich fodders like meadow hay and clover hay. The digestibility of the spring straws does not seem to differ materially from that of the winter straws; both seem to have a higher value than the straw of rape and rape seed, and a value about equal to that of the straw of leguminous crops.

DISEASES OF PLANTS.

Spraying Trees in Winter (*Jour. Bath and West Soc.*, 1914-15; B. T. P. Barker, M.A.).—This experiment was designed to test the effectiveness of spraying trees in the dormant condition. Eggs of Red Spider, Larger Winter Moth, Mussel Scale, and Apple Psylla were used, and the spray fluids were applied to infested twigs and bark in the laboratory.

Red Spider proved very resistant to all the washes. The Apple Sucker was also little affected by the sprays, excepting a 3 per cent. caustic soda solution which killed both eggs and shoot. The Larger Winter Moth appeared very sensitive and was affected by washes of paraffin; paraffin and naphthalene; caustic soda; and caustic potash both alone and along with paraffin, and paraffin and naphthalene. Washes containing caustic potash most influenced the Mussel Scale, and hatching was greatly reduced or entirely prevented. It is emphasised that very different results might have been obtained under field conditions.

POULTRY.

Variation in the Physical Characteristics of Eggs (*U.S. Dept. of Agric., Bur. of An. Ind., Bull. 110, Pt. III.*; Raymond Pearl, Ph.D., and F. M. Surface, Ph.D.).—The data set forth in this bulletin were based

on examination and measurement of about 5,500 eggs from Plymouth Barred Rock pullets. Among the conclusions reached, the following may be mentioned :—

Eggs are relatively more variable in length than in breadth, and are considerably more variable in shape than in either of the linear dimensions, length or breadth; the weight and volume of eggs are much more variable than any of the other characters. All the egg dimensions studied were found to be positively correlated with each other in varying degree. Egg length and egg breadth are correlated only slightly, and neither the weight nor the volume appears to be to any extent correlated with the shape. There is a high correlation between volume and weight, implying that the specific gravity of the egg varies only very slightly.

It was found that the relative variability of eggs is a definite characteristic of the individual, some birds characteristically laying eggs which are extremely variable and other birds characteristically producing uniform eggs. The investigators believe that many of the results found for eggs of the Barred Plymouth Rock will also obtain for the eggs of other breeds.

Bad Effect of Acorns on Laying Hens.—A case in which bad effects on laying hens were ascribed to the feeding of acorns is described in a recent issue of the *Deutsche Tierärztl. Wochenschrift*. In addition to other food each hen received about 1 oz. of shelled, dried and powdered acorns per day. As a result egg-laying diminished and then ceased, although it was spring at the time. A dirty brown discoloration of the skin of the yolk and also of the yolk itself was noticeable. There was no stoppage.

The bad effects were attributed to the astringent effects of the tannin in the acorns on the very sensitive ovary capillaries, while the brown discoloration of the yolk was the result of oxidation. It was thought, also, that the tannin may have affected the assimilation of the proteins in the foods fed, and in this way also hindered egg production.

Steeping the acorns in water is recommended to remove the tannin, but the investigator did not test this point.

Three days after acorn feeding was discontinued laying was resumed and gradually increased.

FORESTRY.

"Brown Oak" and its Origin (*Annals of Botany*, July, 1915, P. Groom, M.A., D.Sc.).—In certain individual British oak trees the ordinary heartwood is partially replaced by a rich-toned, often reddish, brown wood, which is firm and hard, and is termed "brown oak."

"Brown oak" is due to a fungus living exclusively in the heartwood; the fungus presumably infects solely, through a wound, trees sufficiently old to possess heartwood.

"Brown oak" usually occurs at the base of the trunk, and the adjoining root, and generally tapers upwards in the stem and downwards in the root; but the fungus can gain entrance to upper parts of the tree, and so produce in these regions masses of "brown oak" even in individuals devoid of it in their lower parts.

The fungus in the infected tissue is responsible for the production of a brown substance (or substances) highly resistant to solvents, and responding to the reactions of the ill-defined material termed "wound-gum" or "wood-gum."

The fungus (and colour change) advances most rapidly longitudinally and transversely ; the advance in a tangential direction is comparatively slow.

"Brown oak" can remain firm and hard in the tree for a long time ; where decay occurs there is no reason to believe that it is due to this fungus. The tortoiseshell variety of mature "brown oak" is due to the longitudinal darker bands traversing normal coloured wood in the early stages of conversion of heartwood into "brown oak."

The advance of the process of browning is arrested or obstructed by large knots, though burr-wood with numerous small knots may be completely brown.

Tannin is suggested as one of the sources of the food of the fungus.

OFFICIAL NOTICES AND CIRCULARS.

1. THE President of the Board of Agriculture and Fisheries desires to draw attention to the terms of the Circular of 19th November which has been issued to Local Authorities by the
Agriculture and Recruiting. President of the Local Government Board, so far as it relates to agriculture.

Local Authorities have been invited to do everything in their power to assist the work of the local Recruiting Authorities and to constitute committees to deal with questions arising in connection with the new recruiting arrangements. These committees are to be styled "Local Tribunals" and a Central Appeal Tribunal has been appointed by the Government, with Lord Sydenham as Chairman, to deal with cases referred to them by the Local Tribunals.

2. It has been arranged by the War Office that a man who wishes to join the Army may elect either to join the Forces forthwith or to be placed in his group ; that is, (a) he may be enlisted for immediate service with the Colours, or (b) he may be attested, placed in the Reserve (Section B), grouped, and returned to his civil occupation until his group is called up for service.

A man accepted on the latter conditions will be entitled as a soldier in the Reserve to wear a khaki armband which will be given to him by the Military Authorities.

There are 46 groups, 23 for single men (including widowers without children dependent upon them), each year of age constituting a separate group, and 23 similar groups for married men ; the first group consisting of single men aged 18 years, the forty-sixth of married men aged 40. Men married since the 15th August, 1915, the date of registration, will be treated as single men. It is proposed to call up the groups for military service in the numerical order of the groups, except that men of 18 years will not be called up for service in any case until they attain the age of 19 years.

3. Certain classes of skilled agricultural workers have been starred in addition to those employed in other industries, and a list of reserved occupations has also been prepared which includes certain occupations in trades allied to agriculture. The Army Council have issued instructions to all Recruiting Officers that starred men and men on the list of reserved occupations who wish to join the Army shall not be enlisted for immediate service with the Colours. They may only be attested, grouped and passed to the Army Reserve and immediately sent back to

their civil occupations. They will be provisionally exempted from actual service, and will not be called up unless it is decided by the Central Appeal Tribunal that it is no longer necessary in the national interest for them to continue to be provisionally exempted.

The Recruiting Officer may raise a question whether the occupation of any man is, in fact, a starred or a reserved occupation, or whether it is necessary, in the national interest, that the man be still retained in civil employment. The Recruiting Officer must bring the question before the Local Tribunal, who are then to investigate the case and report thereon, with their recommendations, to the Central Appeal Tribunal for decision.

4. There are also the cases of men who are actually engaged in a starred occupation, but who have not been "starred." It will be open to the man or his employer, in a case of this kind, to make an application on the prescribed form in duplicate to the Tribunal for the area in which the man's place of employment is situate, on the ground that the man is in fact, engaged in a "starred" occupation. Forms for the purpose may be obtained from the Clerk to the Local Tribunal.

If the Recruiting Officer agrees to the application the man will be treated as though he had been "starred," and the Local Tribunal will then need only to notify the fact to the man or the employer as the case may be. If, on the other hand, the Recruiting Officer does not assent to the application, the Local Tribunal are to investigate the facts and to report with their recommendation to the Central Appeal Tribunal. If the Central Tribunal decide that the man is engaged in a "starred" occupation the man is to be treated as though he had been "starred."

5. If any "starred" man has inadvertently been enlisted for immediate service with the Colours, the employer should write at once to the Area Commander, whose name and address can be obtained either from the local Recruiting Officer or from the Clerk to the Local Tribunal, the War Office having promised to take all possible steps to transfer the man to the Army Reserve and send him back to civil occupation.

6. In the case of a man who is not in the list of "starred" or "reserved" occupations, but who may be individually indispensable to an employer's business, the employer may bring the case of any such man—if he has been attested, grouped and passed into the Reserve—(but not if he has been enlisted for immediate service with the Colours) before the Local Tribunal with a view to his being placed in a later group, but in these cases the man himself must also state that he is willing to remain in the employer's service if the claim is allowed, and the man's consent to this is therefore made a condition precedent to any claim by the employer.

If the Recruiting Officer raises no objection to the claim, the case may be treated as decided, and the Local Tribunal will notify the employer accordingly. Failing agreement, the Local Tribunal will decide whether the man should be placed in a later group, and, if so, in which group. It is not competent to the Local Tribunal in a case of this kind to decide that a man is to be provisionally exempted from service and not to be called up with the group in which he is placed.

The Local Tribunal cannot place a man back more than 10 groups, but if, when the time comes to call up the group to which the man has been postponed, the circumstances continue to be such as to justify his

being placed in a still later group, application to this effect may be made to the Local Tribunal by the employer or the man as the case may be.

It is important to bear in mind that an application can be made in respect of a man in this class only if he is attested and grouped in the Reserve, not if he enlists and immediately joins the Colours, and there is no obligation on a Recruiting Officer to see that a man who is not starred or included in the list of reserved occupations joins the Army under the condition that he is placed in his group. It will therefore be well that employers who may wish to make a claim in respect of any such men desiring to join the Army, should point out to them that they should join under the condition that they are attested and grouped in the Reserve.

The term "indispensable" will be strictly interpreted. It will not be enough for the employer to show that he will be inconvenienced, even seriously inconvenienced, by the loss of the man. Speaking generally the employer will have to show not only that the man is individually indispensable, but also that every effort has been made to obtain a temporary substitute for him, and that the employer has given reasonable facilities for men in his employment to enlist.

7. Farmers themselves, in common with other employers, have not been "starred," but as it is essential from the national point of view that there should be someone on each farm to direct the business, and ensure the proper cultivation of the land, Lord Selborne considers that farmers of military age who desire to join the Army should not enlist for immediate service with the Colours, but should be attested and grouped in Section B, Army Reserve. If a farmer remains on his farm it should be possible for him in most cases to release his son for military service unless that son is really indispensable to the cultivation of the farm owing to the enlistment of the skilled labourers.

8. Lord Selborne feels sure that in this time of critical need and in view of the arrangements made for the retention of the skilled and indispensable men, farmers and other employers of agricultural labour will do all in their power to adapt themselves to changed conditions and that by the employment of men not eligible for military service, by the employment of women (which can be very much extended), and by the reorganisation of their business generally they will do their very utmost to release men for His Majesty's Forces.

With regard to the recruiting of skilled farm workers, Lord Selborne desires it to be clearly understood that if a skilled agricultural labourer

Recruiting of Skilled Farm Workers. who has been "starred" as such leaves his employment on the farm in order to take up other work not connected with agriculture, the "starring" of that man will cease to be

operative and he will be liable to be canvassed and enlisted for immediate service with the Colours.

Children and Home Production of Food. CHILDREN living in country districts can assist in increasing the home production of food in many ways. At present, if their parents

keep pigs or other live stock, they can help to reduce the cost of feeding by collecting acorns and horse chestnuts, rough grass, etc., for use as fodder. They can also help to economise the use of straw for litter by collecting dried bracken, grass, leaves

and reeds. Suggestions for the use of these materials are given in leaflets issued by the Board of Agriculture and Fisheries, viz., Special Leaflet No. 9 (Acorns, Horse Chestnuts and Beechmast), Special Leaflet No. 10 (Pig-keeping for Cottagers and Smallholders), Special Leaflet No. 34 (Autumn and Winter Fodder), and Special Leaflet No. 38 (Use of Bracken as Litter). Copies of these leaflets may be obtained free of charge and post free on application to the Board, Whitehall Place, London, S.W.

THE Government of the Dominion of New Zealand have modified their requirements relating to the importation of cattle, sheep and swine from the United Kingdom which, for the

Importation of purposes of the amended regulations, is re-
Live Stock into New garded as three separate countries, viz. :—
Zealand.

(1) England and Wales, (2) Scotland, and
(3) Ireland. The following conditions are now applicable, in addition to the usual regulations as to "owner's declaration," etc. :—

(1) No shipment may be made for one month from the date of an outbreak of foot-and-mouth disease, but the occurrence of this disease in one country does not prevent exportation from either of the others.

(2) After one month from the date of the last outbreak, cattle, sheep or swine may be shipped at London, Liverpool or Glasgow from any part of the country provided that, until three months have elapsed since the date of an outbreak, no animals may be exported which during this period have been within a radius of fifteen miles from the infected premises.

(3) Fodder accompanying live stock (including horses) must be the produce of some county where no outbreak of foot and mouth disease has occurred for six months prior to the date of shipment. The fodder must be sent direct from such county to the ship, and a sworn declaration as to its origin must be provided. This restriction applies for a period of six months following an outbreak of foot-and-mouth disease.

THE Board of Agriculture and Fisheries notify that, in accordance with the new requirements of the Argentine Government, official certificates can now be issued in respect of cattle.

Export of British sheep, goats and swine which have been
Live Stock to located during the preceding three and a half
Argentina. months in counties in which foot-and-mouth
disease has not existed during that period.

The exportation of live stock from the United Kingdom is prohibited now by Order in Council, but applications for licences to export may be made to the War Trade Department, 4, Central Buildings, Westminster, S.W.

PART III. of the Agricultural Statistics for 1914, dealing with the prices and supplies of corn, live stock and other agricultural produce in

Prices of England and Wales, has been published by the
Agricultural Produce. Board (Cd. 8112, price 5d.). The returns now include reports on the Guildford, Northampton and Oswestry live stock markets, and on sales of store stock at Haverfordwest, while the particulars concerning prices of fruit and vegetables have been considerably amplified. Comparison of

the prices of 1914 with those of previous years is made by means of an agricultural index number,* and the opening report also deals with the prices obtaining during the first seven months of 1915.

THE President of the Board of Agriculture and Fisheries is now in a position to state that a Show of Thoroughbred Stallions will be held in conjunction with the Hunters' Improvement Society at the Royal Agricultural Hall on **London Thoroughbred Stallion Show, 1916.** 29th February and 1st March, 1916, and that sixty King's Premiums (including twelve Super-Premiums) will be offered for award by the Board on the same conditions as obtained at the show held in March last. Full particulars of these Premiums will be issued in due course.

In addition to the King's Premiums, the Board will be prepared to consider recommendations from their County Light Horsebreeding Committees for the award of, approximately, forty Board's Premiums.

THE following circular letter, dated 26th November, 1915, has been issued to the Secretaries of the County War Agricultural Committees :—

Improvement of Farming and Provision of Labour. SIR.—I am directed by the President of the Board of Agriculture and Fisheries to say that he hopes that one of the matters which the County and District War Agricultural Committees will consider will be whether they can take any steps to secure that land which is at present lying waste or is being badly farmed, should be brought into improved cultivation. Lord Selborne realises that nothing in the nature of large schemes of reclamation involving considerable capital expenditure is practicable under present circumstances, but he is satisfied that much could be done to increase the production of food by bringing into cultivation small areas of land which are at present producing nothing. I am to say that Lord Selborne hopes that your Committee will promote the object in view by assisting Societies and individuals to obtain such land and by providing them with expert advice to ensure its profitable cultivation.

Lord Selborne feels that one of the most important functions of the War Agricultural Committees should be to create a strong public opinion against bad farming and in favour of making the most of the land, and he hopes that your Committee will do all they can in this direction.

The scarcity of labour will make it difficult for farmers to keep their land free from weeds, and a special effort should be made to prevent occupiers of waste or poorly cultivated land from injuring the fields of their neighbours by allowing thistles, &c., to run to seed.

Steps should also be taken to prevent waste of food through the depredations of hares, rabbits, rats, sparrows, and other pests. Suggestions for destroying rats are made in the Board's Leaflet No. 244 and for reducing sparrows in Leaflet 84. The formation of "Rat and Sparrow Clubs" on the lines indicated in the latter leaflet might be recommended by the District Committees.

Labour for the Steam Ploughing Season next Spring.—With a view to considering what steps can be taken to ensure that a sufficient supply

* See p. 911.

of skilled men will be available to work machines for steam cultivating and ploughing during the coming Spring, Lord Selborne would be obliged if your Committee would obtain from the proprietors of steam tackle in your county full particulars of the men required to work the existing sets of machines and of any shortage of skilled men at the present time. Further, as it is possible that the War Office may agree to arrangements being made for the release on furlough of skilled men, who have enlisted, in order to take part in Spring cultivation, any information possessed as to the whereabouts of such men should be supplied.

A draft Form of Enquiry is enclosed* and Lord Selborne would suggest that if your Committee agree, a copy should be sent to each proprietor of steam tackle in your county. When the completed forms are returned to you, Lord Selborne would be obliged if they could be forwarded to this office together with your Committee's observations on the matter generally so far as the position in the county is concerned. The Board will be prepared to supply a sufficient number of copies of the Form for distribution in your county.

I am, &c.,

SYDNEY OLIVIER, *Secretary.*

THE following circular letter, dated 29th November, 1915, has been issued to Local Authorities in England and Wales for the purposes of the Sale of Food and Drugs Acts, 1875 to

**Hardship with
Respect to the Sale
of Milk.**

1907 :—
SIR.—The President of the Board of Agriculture and Fisheries has recently had under consideration representations as to difficulties

and hardship experienced by milk producers as the result of the administration by Local Authorities of the Sale of Food and Drugs Acts with respect to the sale of milk.

The Sale of Milk Regulations provide that milk which falls below the specified limits shall be presumed to be adulterated, but, though the Regulations make it necessary for a Court of law to hold, until the contrary is proved, that such milk is adulterated, it does not necessarily follow that it is in the interest of the consumer or fair to the producer that a Local Authority should direct a prosecution in every case on the mere *prima facie* evidence resulting from the analysis and the Regulations.

It is now well known that, while the average composition of the day's milk of a herd of cows is fairly constant, and is of a quality that would seldom expose producers to risk of prosecution, the variation between the composition of the morning's and the evening's milk may be considerable, particularly where the periods of milking are widely uneven, with the result that the mixed milk of a herd of cows will from time to time contain less than 3 per cent. of butter fat. In the case of an individual cow, wide variations in the quality of the milk will temporarily occur, and if such milk is not mixed, or mixed with the milk of only three or four animals, the analysis may disclose less than 3 per cent. of butter fat.

Lord Selborne suggests, therefore, that before proceedings are instituted on analytical evidence there should be a preliminary investigation by an officer of the Local Authority, or that the milk producer

* Not here printed.

should be given an opportunity of making any explanation or representation which he has to offer.

In some cases a sample of milk is taken at the farm immediately after the cows have been milked, in the presence of the officers of the Local Authority, and if the result of the analysis corresponds with that of the original sample no further action is considered necessary.

The principle of thus comparing the original sample with a sample of a corresponding milking on the farm has been adopted in the Milk and Dairies (Consolidation) Act of this session, the operation of which is at present suspended.

Lord Selborne recognises that it is not possible to adopt the same procedure in all localities, but commends the foregoing observations to the consideration of Local Authorities with a view to preventing the prosecution of innocent persons.

I am, &c.,

SYDNEY OLIVIER, *Secretary*.

THE following circular letter dated December, 1915, has been issued by the Board to Clerks of Parish Councils, to call attention to Special Leaflet No. 32 on War Food Societies:—

**War Food
Societies.**

SIR.—I am directed by the President of the Board of Agriculture and Fisheries to refer to the Circular Letter addressed to you by the Board on the 26th August, 1914, calling attention to the series of Special Leaflets which were being prepared for the guidance of allotment holders and others wishing to increase their supplies of home-grown food, and enclosing copies of the three numbers which had been issued at that date.

Further leaflets in the same series, dealing with various aspects of agriculture, with special reference to the conditions brought about by the War, have been issued from time to time throughout the year, and have been widely distributed through the agency of local bodies and otherwise. In one of the latest of the series, Special Leaflet No. 32, of which copies are enclosed herewith, the Board suggest the formation of War Food Societies for the purpose of increasing the production of food and, at the same time, of securing economy in its utilisation and consumption. It is thought that in most cases the parish will be found to be the most convenient area for the purpose in view, and Lord Selborne desires me to express the hope that he may rely on the vigorous co-operation of your Council in taking immediate steps to bring the subject to the notice of local residents and, by calling a meeting or otherwise, to press forward the formation of a society in your district.

It is believed that substantial economies can be effected in the home production and consumption of food by the organisation of co-operative efforts on the lines indicated in the leaflet; and it is hoped that advantage will be taken of the advice offered by the Board or the Agricultural Organisation Society in the establishment of local societies. The President will also be glad if your Council will assist in making known the facilities for obtaining technical advice outlined in the Special Leaflet No. 25, of which a copy is sent herewith. A list of the Board's Publications is enclosed. Copies of any leaflet required for distribution will be supplied to you post free on application.

I am, &c.,

SYDNEY OLIVIER, *Secretary*.

**Produce of Potato
and Root Crops in
England and Wales
in 1915.**

PRELIMINARY Statement showing the estimated total produce and yield per acre of the potato and root crops in England and Wales in the year 1915, with comparisons for 1914, and the average yield per acre of the ten years 1905-1914.

Crops.		Estimated Total Produce.		Acreage.		Average Estimated Yield per acre.		Average of the Ten Years 1905-1914.
		1915.	1914.	1915.	1914.	1915.	1914.	
ENGLAND AND WALES.	Potatoes..	Tons. 2,858,113	Tons. 2,953,109	Acres 463,399	Acres 461,621	Tons. 6'17	Tons. 6'40	Tons. 6'17
	Turnips and Swedes...	11,806,542	13,450,781	929,224	1,042,438	12'71	12'90	13'13
	Mangold..	7,534,558	7,918,767	412,509	431,366	18'99	18'36	19'43
ENGLAND	Potatoes..	2,702,181	2,807,255	436,940	436,172	6'18	6'44	6'22
	Turnips and Swedes...	11,068,241	12,598,326	878,471	986,869	12'60	12'77	13'01
	Mangold..	7,627,661	7,719,680	401,048	420,335	19'02	18'37	19'46
WALES.	Potatoes..	155,932	145,854	26,459	25,449	5'89	5'73	5'34
	Turnips and Swedes...	738,301	852,455	50,753	55,569	14'55	15'34	15'24
	Mangold..	206,927	199,087	11,461	12,031	18'05	18'05	18'01

NOTE.—The average yield of potatoes per acre in England and Wales is estimated to be exactly equal to the average of the preceding ten years; while the total production, although nearly 100,000 tons below that of last year, is some 180,000 tons above the average. Turnips and swedes have produced less than in 1914 by some 1,644,000 tons, mainly owing to the reduced acreage, although the yield per acre is also a little below that of 1914 and about $\frac{1}{2}$ ton below the average. Mangolds, also on a rather smaller acreage, have yielded some 84,000 tons less than in 1914, but the yield per acre, although about $\frac{1}{2}$ ton below average is $\frac{1}{2}$ ton above that of 1914.

SINCE the 12th November, the date mentioned in the notice contained in last month's *Journal* on the subject of foot-and-mouth

**Foot-and-Mouth
Disease.**

disease, 18 further outbreaks of the disease have been confirmed in Great Britain, up to 11th December, 17 of which were on premises in the county of Somerset, and one in Wiltshire (near Bradford-on-Avon). Of the 18 outbreaks, 3 occurred in the Bath district already scheduled in connection with the previous recent outbreaks, and in the same locality. The remaining 15 outbreaks form a separate group of cases in and around Butleigh, near Glastonbury, some 20 miles from Bath. The first of this series was confirmed on the 15th November, necessitating the issue by the Board of an Order entirely prohibiting the movement of animals over a wide area around Butleigh, adjoining the Bath Scheduled District on the north side. The 14 subsequent outbreaks in this locality were all within a radius of about 5 miles from Butleigh.

By an Order which came into operation on the 29th November, the two Scheduled Districts were amalgamated and the restrictions modified so as to permit of certain movements of stock in those parts of

the district outside four separate areas immediately surrounding the infected premises, in which areas all movement continued to be prohibited.

Later, by an Order which took effect on 6th December, 2 of these prohibited areas were merged into the zone in which the movement of stock by license was allowed, and licensed fat stock markets were permitted in that zone. At the same time the restrictions were withdrawn altogether from the outlying parts of the scheduled district, except in the Glastonbury neighbourhood. A further substantial modification was made as from 13th December by an Order which limited the area subject to restrictions in the Bath district to one of about 7·8 miles radius around the infected premises near Bradford-on-Avon, and in the Glastonbury district to an area of similar extent around Butleigh and West Pennard.

No further case having been reported from Pembrokeshire since that on the 28th October referred to in last month's *Journal*, all remaining restrictions were withdrawn from that district on the 22nd November.

THE Government has accepted the generous offer made by Colonel W. Hall Walker, M.P., Member for the Widnes Division of Lancashire, to present his valuable stud to the Nation.

Purchase of Colonel Hall Walker's Stud. It will also purchase his properties at Tully, Co. Kildare, and at Russley, Wilts, and use them in connection with the maintenance of a proper stock of Army horses in the United Kingdom.

MISCELLANEOUS NOTES.

THE Agricultural Index Number, which was compiled for the first time last year, has been continued as affording an indication of the

**Agricultural
Index Number.***

general change in the price level of the year's produce of the farm. As explained in the Report for 1913,† the annual price of each commodity, or groups of commodities, has been calculated on the general principle of including the market quotations for that part of the year in which the particular produce is sold by farmers; and the General Index Number has been formed by averaging the particular index numbers, weighting them proportionately to the total value sold off the farm, as ascertained by the Census of Agricultural Production in 1908. Judged by this standard the average price of the produce of the farms in 1914 shows a slight fall from 1913, the index number being 111, as against 112 in each of the two previous years.

In a year in which the economic conditions were suddenly changed, as in 1914, statistics dealing with the year as a whole present a somewhat imperfect view of the facts. Prices for the first seven months of 1914 were affected by normal conditions; those for the last five months were affected by war conditions of an unprecedented character. A table is therefore given showing the course of these index numbers month by month. The movement of the General Monthly Index Number, though constructed in the same way as the Annual Index Number, is subject to a larger margin of error, since the quantities of many commodities sold during each month vary greatly according to the season, and the weights

* From the Agricultural Statistics, Part III, 1914 (Cd. 8112, price 5d.).

† See this *Journal* for July, 1914, p. 324.

attributable to each item ought properly to vary in every month. There are, however, in the great majority of cases, no satisfactory data upon which to base any safe estimate of the relative quantities sold at different times of the year; and thus the Monthly Index Number has, perforce, had to be calculated as if the sales of produce were spread equally over the year. It of course remains true that the index number of any particular commodity represents the movements of that commodity as compared with the base period (1906-8), although the General Index Number can only be regarded as very approximate. It may also be observed that the Annual Index Number of any commodity is liable to differ materially from the average of the twelve monthly numbers, since the former represents the price only during the season when the bulk of the produce is sold off the farm.

Index Numbers of Prices of the Produce sold off Farms in England and Wales in 1914.

Average Price, 1906-8 = 100.

Commodities.	1906-8.	January.	February	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year 1914.
Cattle (25)	100	114	116	119	116	114	114	115	120	117	116	120	124	117
Milk (21)	100	121	121	121	91	91	91	91	91	91	127	127	127	109
Sheep (13)	100	116	113	116	113	106	103	106	113	110	110	113	113	110
Pigs (13)	100	127	127	126	122	113	110	106	116	118	119	117	118	118
Hay (11)	100	89	89	86	87	85	83	87	92	95	94	95	98	90
Wheat (8)	100	102	102	103	104	107	112	112	121	123	122	132	140	125
Barley (6)	100	101	102	100	100	100	98	95	108	115	111	113	115	113
Potatoes (6)	100	102	99	98	110	116	112	..	..	90	89	100	116	93
Poultry and Eggs (4) ..	100	117	110	106	100	103	85	89	89	91	107	118	122	103
Fruit (4)	100	102	97	..	..	..	110	91	100	68	71	71	92	92
Wool (3)	100	127	128	131	131	131	129	128	129	128	136	149	150	133
Butter (3)	100	115	111	109	101	94	90	95	107	107	111	115	119	106
Oats (2)	100	108	109	108	106	109	114	115	129	137	131	144	149	137
Hops (1)	100	207	165	181	163	151	153	145	..	104	92	89	94	95
Cheese (1)	100	110	110	111	111	111	104	101	112	107	109	111	114	109
Beans and Peas (1) ..	100	104	101	102	101	100	108	120	121	121	117	129	143	114
Vegetables (1)	100	152	146	139	..	..	..	..	145	115	121	121	126	134
General Index Number ..	100	113	113	114	107	105	104	103	109	107	113	116	120	111

The chief point indicated by the table is that prices of farm produce were falling steadily during spring and summer, until the outbreak of war checked the fall, causing an immediate rise, as between July and August, of somewhere about 6 per cent. After a slight relapse in September, prices continued to rise, and in December were approximately 20 per cent. above the standard of 1906-8.

It has been found possible to carry the Monthly Index Number forward, so as to comprise the first 12 months of the war. The prices realised by farmers for their produce month by month, as compared with the average prices of the three years 1906-8, appear as follows:—

August, 1914	109	February, 1915	131
September, "	107	March "	133
October, "	113	April, "	130
November, "	116	May, "	140
December, "	120	June, "	140
January, 1915	145	July, "	138

For the reasons given above these numbers give only an imperfect measure of the effect of the rise of prices on British farm produce, but they may be regarded as not unfairly representing the broad facts for farming as a whole. Their application to particular classes of farming

differs considerably. The three groups of corn-growing, meat-production, and dairying, show very different results. The course of prices during the first 12 months of war was as follows:—

—	Wheat.	Barley.	Oats.	Cattle.	Sheep.	Wool.	Milk.	Butter.	Cheese.
1914.									
August ..	121	108	129	120	113	129	91	107	112
September ..	123	115	137	117	110	128	91	107	107
October ..	122	111	131	116	110	136	127	111	109
November ..	132	113	144	120	113	149	127	115	111
December ..	140	115	149	124	113	150	127	119	114
1915.									
January ...	160	118	161	131	116	154	127	123	116
February ..	181	133	180	136	119	168	127	127	125
March ..	179	127	179	138	132	182	127	123	136
April ..	182	121	177	144	132	193	118	117	142
May ..	200	130	187	158	135	183	115	109	144
June ..	189	133	186	166	126	185	115	107	143
July ..	172	137	182	169	126	190	115	115	136

In the case of wheat and oats it must be noted that prices were before the war in the one case 12, and in the other 15 per cent. above the average, while for all three crops the main rise occurred after the larger proportion of them had been sold off the farm.

The price of wool affects the grower but slightly, except during the summer months, but cattle and sheep are marketed by farmers more or less in every month.

The value of cheese as an item in the total receipts of farmers is comparatively insignificant, and that of butter is also small in relation to the main products. Milk, however, is, next to cattle, the largest item in the account of British agriculture. The modest rise in price of milk and butter, as compared with that of other farm produce, shows unmistakably that dairy farmers on the whole gained less than those who relied on corn and meat for their revenue.

It is hardly necessary to point out that while these figures give a general indication of increased receipts by farmers for their produce, they afford no guide to the profits made by them, which would necessarily depend upon the extent to which their outgoings for labour, feeding stuffs, fertilisers, and other commodities have increased. For a profit and loss account the data are not available, but it is evident that the turnover of British agriculture during the war was substantially greater than the average, and was probably greater than in any recent year.

Considerable interest has recently been taken in Canada in the cultivation of certain drug plants which formerly grew wild in sufficient quantity but which, owing to extensive collection,

have become somewhat scarce. The Canadian Department of Agriculture have, therefore, published a bulletin on the subject,

giving information as to the commercial prospects of the industry and the habits and methods of cultivation of suitable species.

* An article on "The Cultivation and Collection of Medicinal Plants in England," appeared in this *Journal* for September, 1914, p. 492.

While the advice contained in the bulletin is essentially based on Canadian conditions of soil and climate, certain of the broader recommendations might well prove useful for growers in this country.

It is stated that prospective growers of drug plants must be careful to ascertain exactly the species of plant needed by the manufacturers. Especially in cases where the stock is obtained by digging up wild species, the grower should compare his plants with descriptions and illustrations in reliable publications, and if at all uncertain should seek the advice of a botanist. Growers should make a point of ascertaining the exact part of the plant used in the preparation of medicine, as the inclusion of other parts than that prescribed by the manufacturers would lower the selling price of the produce.

Roots of annual plants should be dug just before the flowering period, those of biennial plants in the autumn of the first year, and those of perennial plants in the autumn of the second or later years of their growth. In some cases the collection may be made very early in spring before growth begins. Underground stems or rhizomes should be collected at the same time of year as perennial roots.

Barks may be collected in winter, or during the spring, when the sap begins to flow and when it is easier to detach the bark.

Leaves should, as a rule, be collected when the plant is in flower, and only the healthy green leaves should be chosen. Where the whole green plant or herb is used the older thick stems should be rejected, and only the younger branches, flowers, and leaves taken.

Flowers should be collected just after they are open, and before they begin to wither. With certain exceptions, fruits are gathered when fully ripe. Seeds should be collected when ripe and just before the seed vessels split or open. In the case of some plants that have numerous small seeds ripening in succession, such as caraway, a branch should be cut as soon as the majority of the seeds on it are ripe.

Most drugs are purchased by the dealers in a dried condition, and the process of drying must be carefully attended to. In warm, dry weather the plants may be spread out in thin layers in the open air, but they should not be exposed to direct sunlight, and should be put under cover at night as a protection against rain and dew; they may also be spread on the clean floor of a barn, being turned frequently. In the autumn and during rainy weather, the plants will require to be dried by artificial heat in a special drying shed with shelves, or in a greenhouse. Large roots may be sliced lengthwise before drying.

Three weeks or longer will be necessary for drying some species, according to the weather conditions and the time of year. The plants should be dried in such a way as to retain, as far as possible, their natural colours. When thoroughly dry they will usually break quite readily. Unless the drying is carefully and thoroughly done, the whole crop may be ruined by the growth of various moulds.

Before collecting drug plants, a sample should be sent to the buyer, giving the name of the plant or drug, and ascertaining what quantity will be purchased and the price offered. If the market is bad, perennial herbs and shrubs can be left in the ground until the following season; but annuals and biennials which cannot be held over must be disposed of even if the price should not be quite satisfactory. (*Canadian Dept. of Agric., Div. of Botany, Bull. No. 23, Second Series: Medicinal Plants and their Cultivation in Canada.*)

A Decree of 5th July prohibits the importation into Argentina of alfalfa seed and seed of other forage plants which contain more than 10 grains of dodder per kilogramme, or which possess a germinating value of less than 60 per cent. (according to analysis which must be made by the Directorate General of Agriculture). The ports of importation for these kinds of seed are Buenos Aires, Rosario, and Bahia Blanca. For the purpose of certificates of analysis and sale of alfalfa seed a margin of 20 grains of "large dodder" per kilogramme is fixed. Various margins are fixed for guarantees of purity and germinating value of alfalfa seed. Alfalfa seed, which does not satisfy the standards necessary for importation may be cleaned and fanned at the expense of the importer at the port of Buenos Aires.

The importation of *Medicago denticulata* or *maculata* and *M. lupulina* is prohibited.

The Decree comes into force on 5th January, 1916.

An Act was passed on 2nd June, 1915, laying down the conditions governing the sale of fertilisers and feeding stuffs in Guernsey.

The vendor of a fertiliser or feeding stuff must, if the quantity sold is 100 lb. or over, furnish an invoice which must state: in the case of a fertiliser, the percentage content of nitrogen, soluble and insoluble phosphates, and potash; and in the case of a feeding stuff, whether it is composed of one, or more than one, ingredient or seed, and, in cases where it has been artificially treated other than by having been mixed, broken, ground, or chopped, the percentage content of oil and albuminoids. The invoice constitutes a guarantee of the facts so stated, certain limits of error being allowed in the case of the above percentage contents figures. With quantities of less than 100 lb. a declaration of the details required in the invoice must be exhibited in a conspicuous position.

Secondly, where the name of the feeding stuff indicates that it is composed of a particular ingredient or of two or more ingredients, and there is no indication that any other ingredient or seed has been mixed, there is held to be a guarantee that the article is composed only of the ingredients or seeds stated.

Thirdly, there is held to be a guarantee that the fertiliser or feeding stuff sold is suitable for use as such.

Besides these legally necessary invoice statements, any further statements made by the vendor as to the content of chemical or nutritive ingredients, as the case may be, in the invoice, contract of sale, letters, memorandum, circular or other advertisement are held to constitute a guarantee.

Regulations are made as to sampling by the purchaser or by the Official Analyst, and submission of samples by the purchaser to the Official Analyst.

Fines are imposed if no invoice, or a false invoice, is furnished, and for the inclusion of deleterious or worthless ingredients in feeding stuffs.

THE *Bulletin of Agricultural and Commercial Statistics* for November, 1915, issued by the International Institute of Agriculture, contains

**Notes on Crop
Prospects and Live
Stock Abroad.**

estimates of the production of cereal crops in the Northern Hemisphere. The countries for which it is possible to give approximate estimates are as follows:—In *Europe*—Hungary, Denmark, Spain, France, Great Britain, Ireland, Italy, Luxemburg, Norway, Netherlands, Rumania, Russia in Europe (54 Governments), Switzerland; in *America*—Canada, United States; in *Asia*—India, Japan, Russia in Asia (10 Governments in 1915 and 9 Governments in 1914); in *Africa*—Egypt, Tunis.

Wheat.—The total production in the aforementioned countries is estimated to amount to 451,051,000 qr. in 1914-15, against 372,052,000 qr. in 1913-14, the increase being equal to 21·2 per cent., while the area sown was greater by 6·8 per cent.

Rye.—In the above-named countries, with the exception of Great Britain, India, Japan, Egypt, and Tunis, the production is calculated to total 137,129,000 qr. this year, against 119,503,000 qr. last year, or an increase of 14·7 per cent., while the area under cultivation was smaller by 0·4 per cent.

Barley.—The total production in the above countries, excluding India, is placed at 145,798,000 qr. in 1914-15, as compared with 125,260,000 qr. in 1913-14, or an increase of 16·5 per cent., but the area sown showed a decrease of 1·2 per cent.

Oats.—For the specified countries, excluding India, Japan, and Egypt, the production is estimated at 396,299,000 qr. this year, or an increase of 23·2 per cent. compared with last year, when the production amounted to 321,733,000 qr. The area sown was greater by 1·1 per cent.

Maize.—In Hungary, Italy, Rumania, Russia in Europe (54 Governments), Switzerland, Canada, United States, Japan, and Russia in Asia (10 Governments in 1915 and 9 Governments in 1914), the total production is estimated at 419,060,000 qr. this year, against 368,397,000 qr. last year, or an increase of 13·8 per cent., the area under cultivation being greater by 5·8 per cent.

In the Southern Hemisphere, the production of wheat in *Australia* is estimated at 17,870,000 qr. in 1915-16, against 3,114,000 qr. in 1914-15.

Russia.—The Central Statistical Committee has published preliminary estimates of the production of winter grain crops in 57 governments and Provinces in 1915 as follows:—Wheat 126,390,000 cwt., as compared with 94,128,000 cwt. in 1914; rye 443,646,000 cwt., against 355,411,000 cwt.; and barley 3,490,000 cwt. against 3,229,000 cwt. in 1914. (*London Grain, Seed and Oil Reporter*, 7th December.)

According to information of the Central Statistical Committee, the condition of the winter cereals up to 14th October, in 61 Governments for which fairly accurate data was received, was extremely favourable. In only one Government the crops appear to be somewhat below average, whilst in the remaining 60 Governments or Provinces the conditions of the sowings were average or over average, the crops being considerably over average or nearly good in 32 Governments. (*Broomhall's Corn Trade News*, 25th November.)

France.—The report of the Ministry of Agriculture on the condition of the winter crops on 1st November, says that wheat is estimated at 73, rye 72, barley 72, and oats 70. (100 = very good, 80 good, 60 fairly good, 50 passable.)

Canada.—The High Commissioner for Canada was informed by the Minister of the Interior at Ottawa, on the 19th November, that the area sown with autumn wheat in Canada was estimated at 1,100,000 acres, and that 53 per cent. of the area intended for next year's crop was ploughed by 31st October.

Argentina.—According to revised estimates issued by the Ministry of Agriculture, the areas sown with wheat, oats and linseed for the 1915-16 crops, are as follows: Wheat, 16,420,000 acres as compared with 15,464,000 acres in 1914; oats, 2,565,000 acres against 2,865,000 acres; and linseed, 4,000,000 acres against 4,255,000 acres in the previous year. (*London Grain, Seed and Oil Reporter*, 24th November.)

South Africa.—According to an official crop report of 20th October, this year's crop of wheat in the Union is expected to be somewhat below that of last year. In the Transvaal and the South-western district of the Cape, considerably larger crops than last year are expected, but these are more than counterbalanced by poorer yields in the Orange River Colony and in the Karroo, Border and North-eastern districts of the Cape. An increase in the yield of oats is expected, but less barley will be produced as compared with last year. (*Broomhall's Corn Trade News*, 4th December.)

Live Stock in India (Native States).—The numbers of live stock in 1913-14 are as follows (the corresponding numbers for 1912-13 being shown in brackets):—Bulls and bullocks 3,948,912 (3,924,387); cows 4,391,217 (4,247,839); bull buffaloes 245,696 (268,901); cow buffaloes 1,519,487 (1,465,877); young stock (calves and buffalo calves) 3,896,289 (3,852,236); sheep and goats 8,306,616 (8,141,110); horses and ponies 175,499 (169,336); mules and donkeys 181,121 (177,053). (*Bulletin of Agricultural and Commercial Statistics*, November, 1915.)

Live Stock in Tunis.—According to the General Census at 31st July, 1915, the numbers of live stock were as follows:—Horses 38,000 against 37,416 on the 31st December, 1913; mules 30,250 against 22,547; asses 86,240 against 95,440; cattle 269,152 against 217,304; sheep 1,119,310 against 728,540; goats 499,164 against 505,417; pigs 12,255 against 17,399. (*Bulletin of Agricultural and Commercial Statistics*, November, 1915.)

The Crop Reporters of the Board, in reporting on the crops and the agricultural conditions in England and Wales on the 1st December,

**Agricultural
Conditions in
England and Wales
on 1st December.**

state that good progress was generally made in the fields during the first half of November, but that the frosts in the latter half of the month delayed operations a good deal. On the whole, autumn cultivation is perhaps rather backward for the time of year, especially in many parts of the north. It is reported that about 70 per cent. of the total area intended for wheat has already been seeded, which is somewhat less than usual. It is also estimated that the total area actually sown now is rather more than 5 per cent. below that sown at the same period of 1914; but at that date nearly four-fifths of the probable area had already been got in. The earliest-sown wheat is showing above ground, and generally appears quite satisfactory: the same comment applies in the case of winter oats and beans.

Roots are generally small in size, but are nearly everywhere sound and of good quality, except where mangolds had been left in the ground

until they were caught by the frosts at the end of the month. Cases of this are reported from all parts of the country, and such fields are probably much damaged. The total production of mangolds, from a rather smaller acreage than last year, is estimated to amount to 7,834,588 tons, or about 84,000 tons less than in 1914: the yield per acre, 18·99 tons, is about two-fifths of a ton below the average, but some two-thirds of a ton above 1914. Turnips and swedes, mainly owing to the reduced acreage, have produced only 11,806,542 tons as compared with 13,450,781 tons in 1914: the yield per acre amounted to 12·71 tons, which was rather below average. The yield of potatoes per acre is estimated to be exactly equal to the average of the past ten years, and the total production is 2,858,113 tons, about 180,000 tons more than the average, although some 100,000 tons less than the abundant crop of 1914.

Live stock have generally done fairly well during November, but the cold weather caused farmers to draw rather largely on their supplies of winter food, and prospects are that winter keep will not be very abundant in most parts of the country.

ACCORDING to statements in the Board's *Monthly Agricultural Report* for 1st December, labour was very scarce, nearly everywhere, during November; and temporary labour, especially, was extremely difficult to obtain. **Agricultural Labour in England and Wales** Wages at Martinmas hirings showed an upward tendency.

The following local summaries give further details regarding agricultural labour in the different districts of England and Wales:—

Northumberland, Durham, Cumberland and Westmorland.—The supply of labour was very deficient. At the Martinmas hirings held during November very few men were seeking places, and farmers were often short-handed for the winter. Wages were extremely high.

Lancashire and Cheshire.—The supply of labour was sufficient for present requirements in one or two districts, but generally the supply was short and wages were rising.

Yorkshire.—The deficiency in the supply of labour became greater, all classes of workers being scarce. Wages were very high.

Shropshire and Stafford.—There was a great deficiency in the supply of labour in this division, temporary hands for turnip lifting being almost unobtainable.

Derby, Nottingham, Leicester, and Rutland.—The supply of labour continued to be very short, and the position as regards skilled men appeared to be getting less favourable, although wages were rising.

Lincoln and Norfolk.—In Lincolnshire the supply of labour was variable; in some districts there was a shortage, whilst others reported that there was just sufficient for present purposes. In Norfolk labour was scarce and the shortage is likely to be felt as time goes on.

Suffolk, Cambridge, and Huntingdon.—The supply of labour was deficient throughout the division, and farmers were experiencing increased difficulty in finding workers. Root lifting was delayed by the shortage. In some parts of Suffolk wages had been increased by 1s. per week during November.

Bedford, Northampton, and Warwick.—Labour was everywhere reported to be deficient, both skilled and casual. The shortage appeared to be most pronounced in Bedfordshire.

Buckingham, Oxford, and Berkshire.—Labour was generally deficient and casual labour was practically unobtainable. In central Buckinghamshire stockmen were doing most of the work, and wages were higher than they have ever been for the winter months.

Worcester, Hereford, and Gloucester.—There was a general shortage of labour, and casual labour was scarce. Women were helping to pull mangolds in many places.

Cornwall, Devon, and Somerset.—Labour was still deficient and will probably be scarcer as time goes on.

Dorset, Wiltshire, and Hampshire.—The shortage of labour was increasingly marked, and temporary hands were almost unobtainable.

Surrey, Kent, and Sussex.—The supply of labour continued to decrease, and it was very deficient in most districts. The scarcity of workers seems to be most felt on dairy farms,

Essex, Hertford and Middlesex.—The shortage was being increasingly felt and in many districts was becoming a serious question.

North Wales.—Labour was scarce, but it was not much felt lately as little work was possible. With more open weather a shortage of labour for turnip lifting was expected.

Mid-Wales.—Labour was very deficient in Montgomery, Radnor and Brecon. In Cardigan the supply seemed sufficient for present requirements, but some apprehension was felt as to the effect of later developments.

South Wales.—Labour was generally deficient, with few exceptions, while a substantial advance in wages was reported in east Carmarthen.

Prevalence of Animal Diseases on the Continent.	The following statement shows that according to the information in the possession of the Board on 1st December, 1915, certain diseases of animals existed in the countries specified:—
---	--

Austria (on the 3rd Nov.).

Foot-and-Mouth Disease, Glanders and Farcy, Swine Erysipelas, Swine Fever.

Denmark (month of Oct.).

Anthrax, Foot-and-Mouth Disease (212 outbreaks), Swine Erysipelas, Swine Fever.

France (for the period 17th Oct.—6th Nov.).

Anthrax, Blackleg, Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (for the period 15th—31st Oct.).

Foot-and-Mouth Disease, Glanders and Farcy, Swine Fever.

Holland (month of Oct.).

Anthrax, Foot-and-Mouth Disease (237 outbreaks), Foot-rot, Swine Erysipelas.

Hungary (on the 3rd Nov.).

Foot-and-Mouth Disease, Glanders and Farcy, Sheep-pox, Swine Erysipelas, Swine Fever.

Italy (for the period 8th—14th Nov.).

Anthrax, Blackleg, Foot-and-Mouth Disease (2,616 outbreaks), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever, Tuberculosis.

Norway (month of Oct.).

Anthrax, Blackleg, Swine Fever.

Rumania (for the period 29th Oct.—5th Nov.).

Anthrax, Foot-and-Mouth Disease, Rabies, Sheep-pox, Swine Fever.

Russia (month of June).

Anthrax, Foot-and-Mouth Disease (397,356 animals), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Spain (month of Aug.).

Anthrax, Blackleg, Dourine, Glanders, Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (month of Oct.).

Anthrax, Blackleg, Swine Erysipelas, Swine Fever.

Switzerland (for the period 8th—14th Nov.).

Anthrax, Blackleg, Foot-and-Mouth Disease (17 "étables" entailing 197 animals, of which 13 "étables" were declared infected during the period), Swine Fever.

No further returns have been received in respect of the following countries:—Belgium, Bulgaria, Montenegro, Serbia.

The Weather in England during November.

District.	Temperature.		Rainfall.				Bright Sunshine.	
	Daily Mean.	Diff. from Average.	Amount.	Diff. from Average.	No. of Days with Rain.		Daily Mean.	Diff. from Average.
<i>Week ending Nov. 6th :</i>	*F.	*F.	In.	Mm.*	Mm.*		Hours.	Hours
England, N.E. ...	41·6	-4·0	0·54	14	- 3	5	2·3	0·0
England, E. ...	43·8	-2·5	0·71	18	+ 4	5	2·0	-0·8
Midland Counties ...	40·4	-5·0	0·47	12	- 5	2	2·7	+0·5
England, S.E....	43·6	-4·4	0·99	25	+ 4	3	3·0	+0·4
England, N.W. ...	40·9	-5·7	0·08	2	-21	2	3·7	+1·6
England, S.W. ...	42·7	-5·5	0·66	17	-11	2	4·7	+2·2
English Channel ...	48·7	-2·9	1·15	29	+ 5	4	3·9	+0·9
<i>Week ending Nov. 13th :</i>								
England, N.E....	42·4	-2·2	0·92	23	+ 8	4	2·9	+0·9
England, E. ...	43·3	-1·8	1·63	41	+28	4	1·9	-0·5
Midland Counties ...	42·3	-2·0	1·89	48	+32	5	2·3	+0·3
England, S.E....	44·4	-2·5	1·64	42	+22	4	2·2	-0·1
England, N.W. ...	43·4	-2·3	1·61	41	+19	5	2·1	+0·3
England, S.W. ...	44·7	-2·7	2·15	55	+28	6	1·6	-0·6
English Channel ...	49·0	-1·8	1·95	49	+24	7	2·5	-0·2
<i>Week ending Nov. 20th :</i>								
England, N.E. ...	35·8	-7·4	0·20	5	- 9	3	2·8	+0·9
England, E. ...	36·7	-6·7	0·35	9	- 4	4	4·2	+2·1
Midland Counties ...	34·7	-8·0	0·19	5	- 9	2	3·5	+1·7
England, S.E....	36·1	-9·1	0·23	6	-11	2	4·4	+2·4
England, N.W. ...	34·0	-10·2	0·28	7	-13	2	4·2	+2·5
England, S.W. ...	36·8	-9·2	0·15	4	-20	2	4·4	+2·3
English Channel ...	42·7	-6·9	0·44	11	-12	3	3·1	+0·6
<i>Week ending Nov. 27th :</i>								
England, N.E. ...	36·2	-5·8	0·16	4	- 9	2	1·6	-0·2
England, E. ...	37·0	-4·8	0·20	5	- 7	3	1·8	0·0
Midland Counties ...	34·3	-7·1	0·01	0	-13	1	1·3	-0·3
England, S.E....	36·1	-7·5	0·01	0	-15	1	2·3	+0·5
England, N.W. ...	33·8	-9·2	0·09	2	-18	1	2·5	+1·0
England, S.W. ...	35·8	-8·8	0·04	1	-21	1	2·8	+0·9
English Channel ...	42·7	-5·6	0·07	2	-18	1	1·3	-0·9

* 1 inch = 25·4 millimetres.

DISEASES OF ANIMALS ACTS, 1894 to 1914.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked
or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	NOVEMBER.		ELEVEN MONTHS ENDED NOVEMBER.	
	1915.	1914.	1915.	1914.
Anthrax:—				
Outbreaks	51	44	528	664
Animals attacked	52	46	595	725
Foot-and-Mouth Disease:—				
Outbreaks	28	—	49	24
Animals attacked	556	—	671	124
Glanders (including Farcy):—				
Outbreaks	6	5	47	91
Animals attacked	8	10	82	275
Parasitic Mange:—				
Outbreaks	68	†—	*770	†1,530
Animals attacked	147	†—	*1,656	†2,642
Sheep-Scab:—				
Outbreaks	22	29	188	188
Swine Fever:—				
Outbreaks	264	374	3,714	4,056
Swine Slaughtered as diseased or exposed to infection ...	951	2,260	15,888	37,768

* Figures for eight months only.

† The Parasitic Mange Order of 1911 was suspended from 6th August, 1914, to 27th March, 1915, inclusive.

IRELAND.

(From the Returns of the Department of Agriculture and
Technical Instruction for Ireland.)

DISEASE.	NOVEMBER.		ELEVEN MONTHS ENDED NOVEMBER.	
	1915.	1914.	1915.	1914.
Anthrax:—				
Outbreaks	1	—	2	1
Animals attacked	1	—	2	1
Foot-and-Mouth Disease:—				
Outbreaks	—	—	—	76
Animals attacked	—	—	—	957
Glanders (including Farcy):—				
Outbreaks	—	—	1	—
Animals attacked	—	—	3	†—
Parasitic Mange:—				
Outbreaks	4	3	68	74
Sheep-Scab:—				
Outbreaks	32	20	378	454
Swine Fever:—				
Outbreaks	17	7	236	185
Swine Slaughtered as diseased or exposed to infection ...	54	39	1,310	919

Unit Prices of Artificial Manures. Statement of cost to the purchaser of 1 per cent. per ton of Nitrogen, Soluble and Insoluble Phosphates, and Potash derived from

	London.	King's Lynn.	Hull.	Newcastle.
	s. d.	s. d.	s. d.	s. d.
Nitrogen from:				
*Sulphate of Ammonia pure ... 95%	15 4½	—	15 6	—
... 93%	—	—	16 7	—
Calcium Cyanamide ...	—	—	14 0½	13 1
Nitrate of Soda ... 95%	—	—	20 0	—
... 90%	20 0	—	20 8	—
Nitrate of Lime ...	—	—	—	—
Soluble Phosphates from:				
Superphosphate 35%	2 8	—	2 6½	2 9
" 33%	2 8	—	2 7	2 10
" 30%	2 9	—	2 8½	3 0
" 26%	3 0	—	2 10½	3 3
Dissolved Bones ...	3 11½	—	3 9	4 2½
Allowed for Nitrogen	20 8	—	19 7	21 11½
Allowed for Insol. Phos.	2 1	—	2 0	2 2½
Insoluble Phosphates (Citric Soluble) from:				
Basic Slag ...	2 3	—	1 10½	—
Insoluble Phosphates from:				
Basic Slag ...	—	—	—	—
Bone Meal ...	1 10	—	1 8½	1 9½
Allowed for Nitrogen	18 1½	—	17 0½	17 6
Steamed Bone Flour ...	1 10	—	1 11	1 9
Allowed for Nitrogen	17 10½	—	18 8½	17 4
Potash from:				
Kainit ...	—	—	—	—
Sulphate of Potash ...	—	—	—	—
Muriate of Potash ...	—	—	—	—
Potash Salts ...	—	—	—	—

NOTE.—These unit prices are based on the *probable* retail cash prices in bags f.o.r. for quantities of not less than 2 tons of the manures mentioned at the ports and places specified, but it should be borne in mind that market prices are fluctuating considerably at the present time. The prices are published by the Board of Agriculture and Fisheries for use in comparing the commercial values of artificial manures. They may also be used as a guide to the probable price per ton of any of the manures mentioned if the unit prices of the constituents of the

* By a special arrangement made with the Sulphate of Ammonia Association, farmers will be able to purchase a certain amount of sulphate of ammonia from manufacturers for £14 10s. per ton, in bags, net cash, delivered in lots of not less than 10 cwt., f.o.r. at the makers' works. These terms apply to sales of a quantity

various sources, at certain ports and Manufacturing Centres, for December, 1915.

Silloth.	Liverpool.	Widnes.	Newport.	Bristol.	Plymouth.
s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
—	—	16 3	15 6	—	—
—	16 5	16 5½	—	16 6	16 2½
—	—	—	—	—	—
—	18 11	19 0½	—	19 4½	18 10½
—	19 0	—	20 1	19 11	19 6
—	—	—	—	—	—
—	—	—	—	—	—
—	2 8½	2 7½	2 7	2 9½	2 9½
—	2 9½	2 8½	2 8	2 10	2 10
—	2 10½	2 9½	2 9	2 10	2 10½
—	3 2	3 1	3 0½	3 2	3 2
—	4 4	4 4	3 11½	4 2½	4 2½
—	22 8	22 7½	20 8½	21 10	21 10
—	4 3½	2 3½	2 1	2 2½	2 2½
—	—	—	—	—	—
—	—	—	—	2 1½	2 7½
—	—	—	—	—	—
—	1 10	1 9½	1 7	1 9	1 11
—	17 11½	18 0½	15 6½	16 11½	18 9
—	1 9½	—	1 7	1 11	—
—	17 7½	—	15 8½	19 1	—
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—

manure are multiplied by the percentages of the constituents found in it, and due allowance is made for the difference between cash prices and credit prices, and for cost of carriage from the nearest centre to the place where it is delivered to the purchaser. If used in connection with the valuation of a compound manure regard must be had to the sources of the constituents, and a reasonable sum must be added for mixing, disintegrating and rebagging the ingredients, bags, and loss of weight.

reserved for autumn use, and hold during November and December, so long as the reserved quantity remains unsold. The price stated is for sulphate of ammonia containing 20·16 N. The unit price, therefore, works out at 14s. 4½d.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES OF LIVE STOCK in ENGLAND and WALES
in November and October, 1915.

(Compiled from Reports received from the Board's Market
Reporters.)

Description.	NOVEMBER.		OCTOBER.	
	First Quality.	Second Quality.	First Quality.	Second Quality.
FAT STOCK :—	per stone.*	per stone.*	per stone.*	per stone.*
Cattle :—	s. d.	s. d.	s. d.	s. d.
Polled Scots	10 11	10 10	11 4	10 8
Herefords	11 3	10 1	11 10	10 9
Shorthorns	11 3	10 2	11 8	10 7
Devons	11 5	10 3	11 11	10 5
Welsh Runts	10 10	10 2	11 6	10 8
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	d.	d.	d.
Veal Calves	10	8½	10½	9½
Sheep :—				
Downs	10½	9½	10½	9½
Longwools	10	9	10	9
Cheviots	11	10½	11	9½
Blackfaced	10½	9½	10	9
Welsh	10	8½	9	8½
Cross-breds	10½	9½	10½	9½
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs :—	s. d.	s. d.	s. d.	s. d.
Bacon Pigs	10 6	9 10	10 6	9 10
Porkers	11 3	10 8	11 3	10 7
LEAN STOCK :—	per head.	per head.	per head.	per head.
Milking Cows :—	£ s.	£ s.	£ s.	£ s.
Shorthorns—In Milk ...	28 18	23 19	27 15	22 15
„ —Calvers ...	28 0	22 19	26 13	22 1
Other Breeds—In Milk ...	26 9	21 7	25 19	20 6
„ —Calvers ...	21 0	19 10	21 10	19 15
Calves for Rearing	2 18	2 5	3 1	2 6
Store Cattle :—				
Shorthorns—Yearlings ...	12 19	10 19	13 2	11 3
„ —Two-year-olds...	17 15	15 11	18 7	16 7
„ —Three-year-olds...	23 4	19 8	24 5	20 9
Herefords —Two-year-olds...	18 19	16 16	20 16	16 15
Devons— „	17 16	15 12	18 10	15 6
Welsh Runts— „	18 10	16 10	19 10	16 19
Store Sheep :—				
Hoggs, Hoggets, Togs, and Lambs—	s. d.	s. d.	s. d.	s. d.
Downs or Longwools ...	47 4	41 10	48 3	40 3
Store Pigs :—				
8 to 12 weeks old	26 2	19 8	28 1	22 0
12 to 16 weeks old	46 5	35 4	45 11	35 8

* Estimated carcass weight.

**AVERAGE PRICES of DEAD MEAT at certain MARKETS in
ENGLAND in November, 1915.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.	Quality.	Birming- ham.	Leeds.	Liver- pool.	Lon- don.	Man- chester.
		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
		s. d.	s. d.	s. d.	s. d.	s. d.
BEEF:—						
English	1st	71 0	72 6	—	72 0	69 6
	2nd	66 6	67 6	—	67 6	66 6
Cow and Bull	1st	64 0	65 6	59 0	63 0	61 0
	2nd	58 6	60 6	53 6	58 6	56 0
Irish: Port Killed	1st	65 6	68 0	68 0	70 0	67 6
	2nd	58 6	65 6	63 6	65 6	64 6
Argentine Frozen— Hind Quarters	1st	66 6	65 6	—	—	—
Fore „	1st	56 6	56 0	—	—	—
Argentine Chilled— Hind Quarters	1st	73 0	70 6	71 0	72 0	71 0
Fore „	1st	57 6	57 6	56 0	56 0	56 0
Australian Frozen— Hind Quarters	1st	64 0	66 0	62 0	—	62 0
Fore „	1st	54 6	58 6	56 0	—	56 0
VEAL:—						
British	1st	84 0	—	—	100 6	—
	2nd	79 6	—	—	88 6	—
Foreign... ..	1st	—	—	—	107 6	—
MUTTON:—						
Scotch	1st	86 6	—	91 6	88 0	91 6
	2nd	84 0	—	87 0	83 6	89 0
English... ..	1st	86 6	88 6	—	83 6	88 6
	2nd	83 0	84 0	—	78 6	84 0
Irish: Port Killed	1st	84 0	—	87 6	80 6	84 0
	2nd	—	—	82 0	76 0	81 6
Argentine Frozen	1st	59 0	59 6	57 6	63 0	57 6
Australian „	1st	55 6	56 6	53 6	53 6	53 6
New Zealand „	1st	60 6	—	—	69 0	—
LAMB:—						
British	1st	—	—	—	—	—
	2nd	—	—	—	—	—
New Zealand	1st	78 6	77 0	76 0	75 0	76 0
Australian	1st	70 6	—	66 0	67 0	66 0
Argentine	1st	69 6	—	66 6	68 0	66 6
PORK:—						
British	1st	98 0	91 0	102 6	98 0	99 0
	2nd	91 6	88 0	95 6	88 6	93 6
Frozen	1st	77 6	74 6	76 0	77 0	—

**AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at
certain MARKETS in ENGLAND in November, 1915.**

*(Compiled from Reports received from the Board's Market
Reporters.)*

Description.	BRISTOL.		LIVERPOOL.		LONDON.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
BUTTER :—						
British	<i>s. d.</i> per 12 lb. 19 0	<i>s. d.</i> per 12 lb. 17 0	<i>s. d.</i> per 12 lb. —	<i>s. d.</i> per 12 lb. —	<i>s. d.</i> per 12 lb. 19 0	<i>s. d.</i> per 12 lb. 18 0
Irish Creamery—Fresh	per cwt. 157 0	per cwt. 151 6	per cwt. 158 0	per cwt. 153 0	per cwt. 158 6	per cwt. 152 0
" Factory	134 0	128 0	133 6	127 0	135 6	127 0
Danish... ..	—	—	173 0	168 0	171 0	166 0
French... ..	—	—	—	—	154 0	148 0
Russian	137 6	129 6	—	130 6	133 0	125 6
Australian	—	—	—	—	164 0	160 0
New Zealand	—	—	—	—	164 0	160 0
Argentine	—	—	—	—	156 6	153 6
CHEESE :—						
British—						
Cheddar	97 6	88 6	94 6	92 6	99 0	92 6
Cheshire	—	—	120 lb. 104 6	120 lb. 101 0	120 lb. 108 0	120 lb. 101 6
Canadian	87 6	85 0	per cwt. 89 0	per cwt. 85 6	per cwt. 87 6	per cwt. 84 0
BACON :—						
Irish (Green)	107 0	104 0	105 0	99 6	105 0	101 6
Canadian (Green sides)	94 6	90 0	94 6	91 6	95 0	90 0
HAMS :—						
York (Dried or Smoked)	141 6	136 0	—	—	148 0	140 0
Irish (Dried or Smoked)	—	—	—	—	141 0	135 0
American (Green) (long cut)	90 0	86 0	90 0	86 0	95 0	91 6
EGGS :—						
British... ..	per 120. 22 1	per 120. —	per 120. —	per 120. —	per 120. 25 7	per 120. 23 11
Irish	22 1	19 0	21 11	20 4	24 0	22 0
Danish... ..	—	—	—	—	24 6	22 6
POTATOES :—						
British Queen	per ton. 95 0	per ton. 81 0	per ton. —	per ton. —	per ton. 101 0	per ton. 91 0
Edward VII.	101 6	88 6	78 6	73 6	96 6	88 6
Up-to-date	97 0	85 0	75 0	71 6	97 6	90 6
HAY :—						
Clover... ..	—	—	170 0	130 0	131 0	122 0
Meadow	—	—	—	—	128 0	119 0

AVERAGE PRICES of British Corn per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1913, 1914 and 1915.

Weeks ended (in 1915).	WHEAT.						BARLEY.						OATS.					
	1913.	1914.	1915.	1913.	1914.	1915.	1913.	1914.	1915.	1913.	1914.	1915.	1913.	1914.	1915.	1913.	1914.	1915.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Jan. 2...	30 5	31 1	44 4	28 6	26 2	29 10	19 10	18 2	26 6				18 2	26 6				
" 9...	30 3	30 11	46 2	28 4	25 11	29 7	19 2	18 4	26 5				18 4	26 5				
" 16...	30 5	31 0	48 9	28 6	26 0	30 5	19 4	18 6	27 6				18 6	27 6				
" 23...	30 11	30 11	51 6	28 10	26 3	31 3	19 4	18 11	28 10				19 1	29 10				
" 30...	31 1	31 1	52 8	28 11	26 6	32 5	20 2	19 1	29 10				18 9	30 3				
Feb. 6...	31 0	31 0	53 3	28 10	26 7	33 7	20 1	18 9	30 3				18 11	31 1				
" 13...	30 9	31 0	54 8	29 1	26 7	34 7	20 2	18 11	31 1				18 11	31 1				
" 20...	30 11	31 0	56 0	28 8	26 7	34 11	20 7	18 11	31 5				18 11	31 8				
" 27...	31 0	31 0	56 0	28 6	26 6	35 3	20 4	18 11	31 8				18 9	31 8				
Mar. 6...	31 3	31 5	55 11	28 5	26 2	34 6	20 0	18 9	31 8				18 6	30 7				
" 13...	31 1	31 6	54 8	27 11	26 0	33 5	20 2	18 7	31 0				18 8	30 6				
" 20...	31 1	31 5	53 9	28 6	25 8	32 2	19 11	18 6	30 7				18 8	30 6				
" 27...	31 3	31 4	54 3	27 6	25 7	31 11	19 7	18 8	30 6				18 5	30 6				
Apl. 3...	31 4	31 6	54 6	27 0	25 6	31 9	19 2	18 5	30 6				18 4	30 4				
" 10...	31 3	31 5	54 9	27 8	26 8	31 3	19 2	18 4	30 4				18 5	30 5				
" 17...	31 6	31 7	55 4	26 11	25 4	30 10	18 10	18 4	30 5				18 5	31 5				
" 24...	31 8	31 9	56 5	26 7	26 6	31 5	19 3	18 5	30 11				18 9	32 4				
May 1...	32 2	31 9	58 3	25 11	26 0	32 7	19 6	18 5	31 5				18 11	32 5				
" 8...	32 6	32 2	60 5	25 9	25 6	33 3	19 6	18 11	32 5				19 0	32 8				
" 15...	32 10	32 7	61 7	25 4	26 3	34 0	19 9	19 0	32 8				19 4	32 7				
" 22...	32 10	33 0	62 0	25 3	25 10	34 1	19 11	19 0	32 8				19 4	32 5				
" 29...	32 7	33 9	61 11	26 1	26 1	34 8	20 1	19 4	32 5				19 9	31 9				
June 5...	32 10	34 0	61 9	26 2	25 11	35 4	19 8	19 4	32 5				20 0	32 8				
" 12...	32 8	34 1	60 1	24 7	24 11	34 5	20 2	19 8	32 4				20 0	32 8				
" 19...	32 8	34 1	56 1	23 10	25 10	34 3	19 8	19 9	31 9				20 0	32 8				
" 26...	32 8	34 3	52 0	24 3	25 4	34 4	19 1	20 0	32 9				20 0	32 8				
July 3...	33 1	34 4	49 5	25 2	24 6	35 3	21 0	19 9	31 1				20 0	32 8				
" 10...	33 4	34 2	50 1	25 10	24 9	34 7	19 4	20 0	31 6				20 5	32 1				
" 17...	33 6	34 1	52 7	24 9	24 2	35 8	20 5	19 10	31 6				20 8	32 1				
" 24...	33 10	34 0	53 10	24 1	24 7	35 10	20 8	19 9	32 1				20 3	31 1				
" 31...	34 1	34 2	55 3	24 5	25 9	36 1	20 3	19 8	31 1				20 3	31 1				
Aug. 7...	34 1	34 9	55 4	24 9	25 2	35 7	19 0	19 1	31 5				20 3	31 1				
" 14...	34 3	34 3	55 2	24 7	29 4	37 0	18 7	25 1	31 7				20 3	31 1				
" 21...	33 7	38 9	54 3	26 5	29 10	39 4	18 8	24 3	31 4				20 3	31 1				
" 28...	32 7	36 2	51 11	29 0	30 3	38 3	17 10	23 5	30 0				20 3	31 1				
Sept. 4...	31 11	36 5	45 3	30 11	30 6	38 1	17 8	23 9	26 10				20 3	31 1				
" 11...	31 9	37 10	43 0	31 5	29 11	37 11	18 0	23 11	26 8				20 3	31 1				
" 18...	31 7	38 3	42 9	30 9	29 5	39 0	17 11	23 8	26 4				20 3	31 1				
" 25...	31 6	37 6	43 3	30 1	29 3	39 8	17 9	23 3	26 1				20 3	31 1				
Oct. 2...	31 3	37 1	43 5	29 9	29 1	40 4	17 10	22 9	26 5				20 3	31 1				
" 9...	31 0	36 8	44 1	29 1	28 10	41 0	17 10	22 5	26 5				20 3	31 1				
" 16...	30 11	36 7	45 9	28 8	28 8	42 3	17 9	22 4	27 1				20 3	31 1				
" 23...	30 7	37 2	48 2	28 7	28 7	44 0	18 0	22 5	28 1				20 3	31 1				
" 30...	30 1	37 10	50 3	28 2	28 3	46 2	17 9	23 7	29 1				20 3	31 1				
Nov. 6...	30 0	38 8	51 6	28 1	28 6	47 3	17 9	23 7	30 4				20 3	31 1				
" 13...	30 1	39 8	52 8	27 8	29 0	47 5	17 11	24 8	30 11				20 3	31 1				
" 20...	30 4	41 0	53 6	27 5	29 8	47 11	18 1	25 5	31 3				20 3	31 1				
" 27...	30 9	41 11	54 2	27 0	30 3	48 7	18 4	25 8	31 1				20 3	31 1				
Dec. 4...	31 2	42 2	53 7	26 8	30 2	48 11	18 4	25 9	30 11				20 3	31 1				
" 11...	31 2	42 1		26 5	29 11		18 6	25 9					20 3	31 1				
" 18...	31 2	42 7		25 11	29 8		18 5	25 9					20 3	31 1				
" 25...	31 0	43 3		25 10	29 9		18 4	25 11					20 3	31 1				

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of British Wheat, Barley, and Oats at certain Markets during the Month of November, 1914 and 1915.

	WHEAT.		BARLEY.		OATS.	
	1914.	1915.	1914.	1915.	1914.	1915.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
London	42 4	54 11	30 10	49 4	24 11	31 10
Norwich	39 10	52 7	28 9	48 3	25 3	30 7
Peterborough ...	40 10	53 3	30 3	49 3	25 3	30 11
Lincoln	40 5	53 7	29 8	48 4	25 3	30 6
Doncaster	40 7	52 11	29 3	44 11	24 5	30 9
Salisbury	40 1	52 3	29 4	48 5	24 9	31 3

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

- Harvey, W. J., and Reppien, C.*—Denmark and the Danes: A Survey of Danish Life, Institutions, and Culture. (346 pp.) London: T. Fisher Unwin, 1915. 12s. 6d. net. [63(489).]
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- Wells, S. R.*—Germany's Food. Can it Last? The German Case as Presented by German Experts. (232 pp.) London: University of London Press, 1915. 2s. net. [63(43).]
- Knox, G. D.*—The Spirit of the Soil: An Account of the Nitrogen Fixation in the Soil by Bacteria and of the Production of Auximones as Promoted by Bacterised Peat. (242 pp.) London: Constable & Co., 1915. 2s. 6d. net. [576.83; 662.6.]
- Redfield, C. L.*—Dynamic Evolution: A Study of the Causes of Evolution and Degeneracy. (210 pp.) New York and London: G. P. Putnam's Sons, 1914. [575.1.]
- Cornwall County Council.*—Suggestions for the Assistance of Women's Committees . . . to Organise the Labour of Women and Girls in Cornwall, who are willing to help in Agricultural Pursuits during the War. (17 pp.) 1915. [376.]

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- Amos, P. A.*—Processes of Flour Manufacture. (280 pp.) London: Longmans, Green & Co., 1912. 4s. 6d. net. [664.6.]
- Carter, H. R.*—Cordage Fibres: Their Cultivation, Extraction, and Preparation for Market. (112 pp.) London: John Bale, Sons & Danielsson, 1909. 2s. 6d. net. [63.341.]
- Rome, International Institute of Agriculture.*—Statistical Notes on the Production, Imports, and Exports, Prices, and Maritime Freights of Cereals. (39 pp.) Rome, 1915. 25 centimes. [63.31.31.]
- Perfumery and Essential Oil Record.*—Special Number, 11th June, 1915. The Chemistry, Analysis, and Technology of Essential Oils, with Notes on other Natural Perfumery Products. (141-196 pp.) [63.345.]
- Norway, Bureau Central de Statistique.*—Données sur les Prix du Blé et des Pommes de Terre, 1836-1914. (32 + 33 pp.) Kristiania, 1915. [63.31.31; 63.512.31.]

